Generic Advertising in an Asymmetric Cournot Oligopoly

Yuqing Zheng, Talia Bar, and Harry M. Kaiser

We examine how benefits of mandated generic advertising vary with firm size in an asymmetric Cournot oligopoly market. Generic advertising, funded through a mandatory assessment, changes demand but also increases firms' costs. The effect on a firm's profits depends upon the nature of the change in demand and the company's market share. Situations are identified in which generic advertising: (1) disproportionately favors large (small) firms; (2) decreases profits; and (3) increases (decreases) social welfare. Our findings explain the concerns that are often raised on small firms being disadvantaged by generic advertising. We discuss implications for policy and for firms' advertising strategies.

Key words: Cournot, demand rotation, demand shift, disproportionately, firm size, generic advertising, welfare.

JEL codes: L13, M37.

Generic advertising is "the cooperative effort among producers of a nearly homogeneous product to disseminate information about the underlying attributes of the product to existing and potential consumers for the purpose of strengthening demand for the commodity" (Forker and Ward 1993, p. 6). Many agricultural and food commodities (e.g., beef, cotton, fluid milk, grapes, orange juice, peanuts, pork, and raisins) and nonagricultural commodities (e.g., aluminum, life insurance, natural gas, newspapers, propane, and steel) use generic advertising. Nearly all generic advertising campaigns for agricultural and food commodities and some for nonagricultural commodities are funded through a mandatory unit or value assessment (checkoff) on producers and first handlers. The "Propane. Exceptional Energy" advertising campaign, for example, has been funded through a $0.005 per gallon assessment on U.S. odorized propane producers and importers (unit assessment) and the "Pork: the Other White Meat" advertising campaign has been funded through an assessment of $0.40 per $100 of market value on U.S. pork producers and importers (value assessment).

Mandatory assessment programs avoid the free-rider problem inherent in voluntary programs but raise several firm-specific equity concerns, mainly related to whether the distribution of generic advertising benefits is equitable based on product quality and firm output. Some producers/handlers of higher-quality products are concerned that generic advertising may reduce product differentiation of competing brands by suggesting to consumers that all products within a commodity are the same. This concern was evidenced by a number of court cases including *Glickman v. Wileman* [521 U.S. 457, 1997] and *U.S. v. United Foods* [U.S. 00-276, 2001], and was also supported by an empirical study and a lab experiment study (Crespi and Marette 2002; Chakravarti and Janiszewski 2004).

The second equity concern arises when producers/handlers feel that their returns are not proportional to their contributions. A major complaint of many small producers/handlers is that money poured into large-scale generic advertising campaigns helps only large producers/handlers and does little for the rest of the industry (*The Kiplinger Agriculture Letter* 2001). An article in *The New York Times* (2003) described the situation well:

> What makes this battle over checkoffs especially heated is not just

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> the millions of dollars at stake. It is the fact that the checkoff issue calls attention to the radical split between large and small farmers. Since the mid-1980s, when commodity promotion programs began, the concentration of farming in fewer and fewer hands has increased sharply, especially in the hog business. It is hard for a small farmer to justify giving up any of his earnings to help pay for advertising that *disproportionately benefits* [emphasis ours] gigantic corporate farms. If the USDA valued small farmers, as it claims, it would accede to the courts, not to the pressure of industry groups.[1]

If a producer/handler feels that the share of returns is not proportional to the required contribution, an equity problem potentially exists, and that producer may oppose the program (Ward 2006). For example, as a result of small producers' discontent, the pork checkoff was once voted down in a hog producer referendum conducted in 2000.

One of our main goals in this research is to address the second equity concern by examining, from a theoretic standpoint, how generic advertising benefits vary with firm size (its market share) in an asymmetric Cournot market. We also examine the welfare effect of generic advertising, which so far received little attention in the literature. An oligopoly market structure seems appropriate for certain nonagricultural commodities that have generic advertising (e.g., propane) and for agricultural commodities that have processor-funded generic advertising (e.g., U.S. and California fluid milk).[2] A number of agricultural commodities have producer-funded generic advertising (e.g., dairy, pork, and California almond). Since there are a large number of producers in these markets, one might expect producers in these markets to be price takers. While a perfectly competitive model might describe some agricultural markets, other markets might be better described as oligopolistic. This may occur, for example, when there exist farmer cooperatives (e.g., Blue Diamond Growers Cooperative), government intervention, and farming consolidation (Kaiser and Suzuki 2006, p. 27; Spulber 2004, pp. 320–21). Moreover, even when the total number of producers is large, geographic market divisions may allow firms to enjoy market power.

Farmer cooperatives may create imperfectly competitive markets by controlling production and/or selling quantities. Empirically, Madhavan, Masson, and Lesser (1994) found that Associated Milk Producers, Inc., a cooperative with more than 30,000 members, formed and maintained its market power over a few years in the face of nearly free entry. Promulgation of marketing orders that control volume and quality, and minimum prices, can lead to agricultural producers' oligopoly power, too. Kawaguchi, Suzuki, and Kaiser (2001) found that the Class I premiums could be approximately negotiated by U.S. dairy cooperatives from the Cournot-Nash solution without government intervention. Similar result was found for the Japanese dairy market (Kawaguchi, Suzuki, and Kaiser 1997). Although there are a large number of agricultural producers, Spulber (2004) argued that actual agricultural markets can be different from the perfectly competitive ideal because there are also many large producers and there is geographic market division. An example of megafarm is Smithfield Food Inc., which, through the acquisition of Premium Standard Farms, owns hundreds of hog farms and accounts for about 20% of U.S. hog production (Kilman 2006). Overall, our results will also apply to those industries where producer-funded generic advertising and producers' oligopoly power coexist.

Generic advertising affects market equilibrium by increasing a firm's marginal cost of production through a unit or value assessment and by affecting demand. While expanding market demand is typically thought of as a goal of generic advertising, the nature of the change in demand can vary (for example, demand can become more or less elastic), and our analysis shows that this has important implications for firm profits. This study builds on a literature that has separately examined how an oligopoly market equilibrium responds to a cost shock (Seade 1985; Dixit 1986; Février and Linnemer 2004), a parallel demand shift, or a demand rotation (Hamilton 1999; Chung and Kaiser 2000a; Johnson and Myatt 2006), and a combination of demand shift and rotation

[1] Both articles cited in this paragraph are op ed pieces.

[2] Consider, for example, the fluid-milk processor market in New York State. From 1997 to 2005, the four-firm concentration ratio in the fluid-milk processor market in New York City hovered around 0.60 and the ratio was much higher—around 0.80—in the four smaller regional markets: Albany, Buffalo, Rochester, and Syracuse. Data source: The Division of Dairy Industry Services and Producer Security, New York State Department of Agriculture and Markets.

(Quirmbach 1988).[3] Quirmbach (1988) examined only a symmetric oligopoly. Since generic advertising fits squarely into a context in which a cost shock serves to shift and/or rotate the demand curve, we unify these separate studies in the literature by examining the various effects of generic advertising in a Cournot market. Both asymmetric and symmetric Cournot markets are analyzed in this study, as are both types of generic advertising funding—unit and value assessments.

We find that the effect of a generic advertising program on a participating individual firm's profit depends on the nature of the change in market demand and also on the firm's market share. Accordingly, the effect of a generic advertising program on the industry profit and social welfare depends on the nature of the change in market demand and also on the industry's market concentration. Even if advertising expands demand at all price levels, some firms' profits still may decrease, which can cause a decrease in the industry profit and a subsequent social welfare loss.

The Asymmetric Cournot Model with Generic Advertising

We introduce generic advertising to a standard asymmetric Cournot competition model. We focus on the prevalent funding mechanism—that generic advertising is funded by a unit assessment. We show (see online supplementary material) how the model can be modified to account for advertising funded by a value assessment where each firm's contribution is proportional to its revenue. The individual firm's profit effect from a value assessment is shown to be qualitatively indistinguishable from that of a unit assessment.

Consider an industry that produces a homogeneous good by a fixed number of firms, $N \geq 2$, that compete according to a Cournot oligopoly. The industry had no prior generic advertising program and starts funding one via a unit assessment of τ on its output, Q. The generic advertising program's expenditures are $A = \tau Q$. The inverse market demand curve is given by $\tilde{P}(Q, A)$. Demand can be further expressed as $P(Q, \tau)$ by utilizing the relationship between A and τ. Assume that demand is twice continuously differentiable. Let $P_Q \equiv \partial P/\partial Q$ represent the slope of the inverse demand. We assume that $P_Q < 0$ and $P_Q + q_i P_{QQ} < 0$ hold throughout. The assumption of $P_Q < 0$ states that the demand curve slopes downward regardless of advertising-induced demand changes. The assumption of $P_Q + q_i P_{QQ} < 0$ implies that each firm's reaction curve slopes downward. These are the two weak stability conditions (Vives 1999) required for the Cournot model.

We assume that advertising can affect demand in a general fashion. That is, following Quirmbach (1988) and Hamilton (1999), we examine cases in which the parameter τ induces a parallel demand shift, a rotation of the demand curve through the initial equilibrium point, or a demand shift accompanied by some rotation of the demand curve. This is a crucial assumption because we will show in the following sections that the nature of the change in demand has important implications for firm profits. $P_{Q\tau} \equiv \partial P_Q/\partial \tau$ measures how much the slope of the demand changes with τ with $P_{Q\tau} > 0$ denoting an elastic (counterclockwise) rotation and $P_{Q\tau} < 0$ denoting an inelastic (clockwise) rotation. Note that $P_{Q\tau} > 0$ means that the slope of the (inverse) demand function becomes less negative, making this curve less steep and thus demand more elastic as τ increases. Entry or exit by firms is assumed to be unaffected by advertising (τ). Firm i's cost function is $C_i(q_i)$, with a constant marginal cost c_i for any output level q_i.

Profit for the ith firm (for $i = 1, 2, \ldots, N$) is:

$$\pi_i = [P(Q, \tau) - \tau]q_i - C_i(q_i). \quad (1)$$

Differentiating π_i with respect to q_i yields the first-order condition:

$$P(Q, \tau) - \tau + q_i P_Q(Q, \tau) - c_i = 0. \quad (2)$$

We totally differentiate equation (2) and rearrange to yield firm i's equilibrium output change:

$$dq_i = -\frac{P_Q + q_i P_{QQ}}{P_Q} dQ - \frac{P_\tau - 1 + q_i P_{Q\tau}}{P_Q} d\tau = -(1 - s_i E)dQ - \frac{P_\tau - 1 + q_i P_{Q\tau}}{P_Q} d\tau \quad (3)$$

[3] Hamilton (1999) also examined the situation that has a parallel demand shift and a demand rotation, under the special condition that $P_\tau E + Q P_{Q\tau} > 0$. He did not offer welfare analysis.

where s_i is firm i's market share and $E \equiv -QP_{QQ}/P_Q$ is the elasticity of the slope of the inverse demand curve at the initial equilibrium point. A positive E, a negative E, or $E = 0$ implies a convex, a concave, or a linear demand function, respectively, all of which are consistent with the standard consumer theory model. We follow the literature (Dixit 1986; Février and Linnemer 2004) to assume that $E < 2$ throughout this study, which guarantees the existence and uniqueness of the Cournot equilibrium. Note that the two stability conditions imply that $1 - s_i E > 0$. The $1 - s_i E$ term measures firm i's response to rivals' output. For convex demand, larger firms contract less in response to rivals' expansions, or in other words, larger firms have flatter reaction curves.[4] The term $-(P_\tau - 1 + q_i P_{Q\tau})/P_Q$ in equation (3) measures firm i's horizontal output response to changes in the assessment and increases with firm size if $P_{Q\tau} > 0$.

Summing equation (3) over i, making use of $\sum_{i=1}^N (1 - s_i E) = N - E$, and rearranging yield:

$$\text{(4)} \qquad \frac{dQ}{d\tau} = \frac{N(P_\tau - 1) + QP_{Q\tau}}{\Omega}$$

where $\Omega = -P_Q(1 + N - E) > 0$. Plugging the industry output effect in equation (4) back into equation (3) yields the individual firm's output effect:

$$\text{(5)} \qquad \frac{dq_i}{d\tau} = \frac{\begin{array}{c}(P_\tau - 1)(s_i NE - E + 1)\\ +QP_{Q\tau}(s_i N + s_i - 1)\end{array}}{\Omega}.$$

Using $dP = P_Q dQ + P_\tau d\tau$ and equations (4) and (5) leads to the net price effect:

$$\text{(6)} \qquad \frac{dP}{d\tau} - 1 = \frac{(P_\tau - 1)(1 - E) - QP_{Q\tau}}{-\Omega/P_Q}.$$

Let $H \equiv \sum_{i=1}^N s_i^2$ denote the Herfindahl-Hirschman index as the measure of market concentration. It turns out that the effects of the generic advertising assessment rate on the individual firm's market share and on market concentration can all be expressly linked to the net price effect as follows:

$$\text{(7)} \qquad \frac{ds_i}{d\tau} = \frac{(s_i N - 1)}{-QP_Q}\left[-\left(\frac{dP}{d\tau} - 1\right)\right]$$

and

$$\text{(8)} \qquad \frac{dH}{d\tau} = \frac{2(HN - 1)}{-QP_Q}\left[-\left(\frac{dP}{d\tau} - 1\right)\right].$$

The effect of the generic advertising assessment rate, τ, on an individual firm's profit can be expressed as $d\pi_i/d\tau = q_i P_Q(dQ/d\tau - dq_i/d\tau) + (P_\tau - 1)q_i$ by totally differentiating firm i's profits described in equation (1) and making use of the first-order condition described in equation (2). Utilizing equations (4) and (5) yields the effect of τ on the individual firm's profit:

$$\text{(9)} \qquad \frac{d\pi_i}{d\tau} = \frac{\begin{array}{c}s_i[(P_\tau - 1)(s_i NE - 2E + 2)\\ +QP_{Q\tau}(s_i N + s_i - 2)]\end{array}}{-\Omega/(QP_Q)}.$$

Aggregating equation (9) over i yields the industry profit effect:

$$\text{(10)} \qquad \frac{d\Pi}{d\tau} = \frac{\begin{array}{c}[(P_\tau - 1)(HNE - 2E + 2)\\ +QP_{Q\tau}(HN + H - 2)]\end{array}}{-\Omega/(QP_Q)}.$$

In equation (9), the denominator is positive and the same for all firms. We refer to the term $(P_\tau - 1)(s_i NE - 2E + 2)$ as the "net price impact" since $P_\tau - 1$ is the marginal effect of τ on the net price, $P - \tau$. We refer to the second term, $QP_{Q\tau}(s_i N + s_i - 2)$, as the "slope impact" because the marginal effect of τ on the slope of the price is $P_{Q\tau}$. As equation (9) shows, the individual firm's profit effect is generally a quadratic function of firm size, an issue that will be explored in detail in the next section.

Since consumer surplus (CS) is $\int_0^Q P(z,\tau)dz - PQ$, the consumer surplus effect is:

$$\text{(11)} \qquad \frac{dCS}{d\tau} = \int_0^Q [P_\tau(z,\tau) - P_\tau(Q,\tau)]dz - QP_Q\frac{dQ}{d\tau} = \int_0^Q \left[\int_0^z P_{Q\tau}(u,\tau)du - \int_0^Q P_{Q\tau}(u,\tau)du\right]dz - QP_Q\frac{dQ}{d\tau}.$$

The first expression of the consumer surplus effect was developed by Quirmbach (1988). We develop the second expression (available

[4] The relationship between $1 - s_i E$ and the slope of the reaction curve, L_i $(-1 < L_i < 0$ under $P_Q < 0)$, is $1 - s_i E \equiv -L_i/(1 + L_i)$ (Farrell and Shapiro 1990a; 1990b).

in online supplementary material) to allow for insight into the effect of demand rotation on consumer surplus. Finally, the welfare effect ($dW/d\tau$) is the sum of equations (10) and (11).

Effect on Firms' Profits and on Welfare

In this section, we examine how the effects of a unit assessment on firms' profits are influenced by the nature of the change in demand, by the market structure, and by each firm's size (or market share). Generic advertising affects market demand in a nonlinear fashion. We consider several typical scenarios. We begin with advertising that parallel shifts demand, then we consider an elastic or an inelastic rotation of the demand curve, and finally we evaluate two combinations of these effects. These scenarios are defined by different combinations of values that P_τ and $P_{Q\tau}$ take and allow for insight into how generic advertising's effect on demand influences the assessment's effect on profit. Furthermore, we examine how generic advertising affects social welfare in these different scenarios.

As we described in the introduction, small firms have raised concerns that generic advertising disproportionately favors large firms. Of special interest is to examine such equity concerns by identifying conditions under which either small or large firms benefit more than others from generic advertising. To be more specific, by "proportionately" we mean that firm i's return ($d\pi_i$) is proportional to its contribution ($d\tau q_i$); or in other words, all of the firms' return-to-contribution ratios are equal.

Parallel Increase in Demand

The first scenario, where $P_\tau > 1$ and $P_{Q\tau} = 0$, is a parallel increase in demand, which is a simple demand shift (see figure 1a for illustration using a linear demand curve). In this scenario, generic advertising successfully raises the price at the margin by more than it increases cost, but does not rotate demand. The individual firm's profit effect now reduces to:

$$(12) \qquad \frac{d\pi_i}{d\tau} = \frac{s_i[(P_\tau - 1)(s_i NE - 2E + 2)]}{-\Omega/(QP_Q)}$$

which, for a nonlinear demand curve, is a quadratic function of the market share (s_i) that passes through the origin. For an asymmetric oligopoly, the curvature of the demand curve plays a crucial role in determining the shape and position of the quadratic function, equation (12). Firm i's return-to-contribution is:

$$(13) \qquad \frac{d\pi_i}{d(\tau q_i)} = \frac{[(P_\tau - 1)(s_i NE - 2E + 2)]}{-\Omega/P_Q}.$$

When $E = 0$, equation (13) is not firm-specific, indicating that all firms benefit proportionately from generic advertising. However, when $E > 0$, the return-to-contribution ratio, equation (13), increases with firm size so large firms benefit disproportionately. On the other hand, small firms benefit disproportionately when $E < 0$.

For a nonlinear demand, not only are firms' benefits from generic advertising disproportionate to their contributions, but it is even possible that some firms' profits decline. As seen in equation (12), the effect of advertising on an individual firm's profit ($d\pi_i/d\tau$) is a quadratic function of its market share. It is U-shaped for a convex demand function $E > 0$ and inverse-U-shaped for a concave demand function $E < 0$. We now show that the direction of the effect of advertising on profits depends on the curvature of the demand function as well as on the firm's market share. Let $\bar{s}_1 = 2(E-1)/(NE)$ be the positive market share s_i that solves $d\pi/d\tau = 0$ (where the profit effect $d\pi/d\tau$ is give in equation (12)). Whether or not a firm profits from generic advertising depends on how its market share compares to the threshold $\bar{s}_1$. When demand is linear, all firms have a positive profit effect, and they benefit proportionately. For concave demand where $E < 2/(2-N)$, the threshold lies between zero and one, and a firm's profit increases with τ if and only if its size is smaller than $\bar{s}_1$. For less concave demand where $2/(2-N) \leq E < 0$, the threshold ratio is greater than or equal to one; so profits for all of the firms increase with τ regardless of their size.[5] Note that if $E < 2/(2-N)$, the number of firms with a share in the range of $s_i < \bar{s}_1$ is never zero because a firm with size $1/N$ satisfies $s_i < \bar{s}_1$, that is, there must be at least one firm that profits from generic advertising. Figure 2a graphically illustrates these two cases under the curves denoted as "shift only." For convex demand, the opposite phenomenon occurs. For $0 < E \leq 1$, the threshold, $\bar{s}_1$, lies on or to the left of the origin and all of the firms' profits increase with τ. For $1 < E < 2$, $\bar{s}_1$ lies between zero and one;

[5] This also holds for the trivial case of $N = 2$.

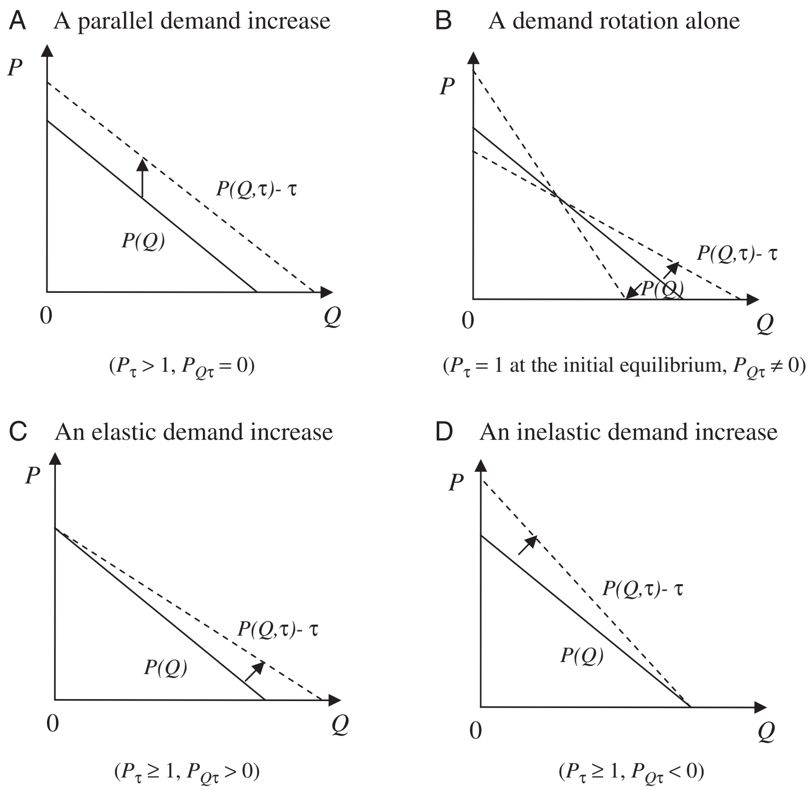

Figure 1. Generic advertising's effect on the market demand curve: four typical scenarios

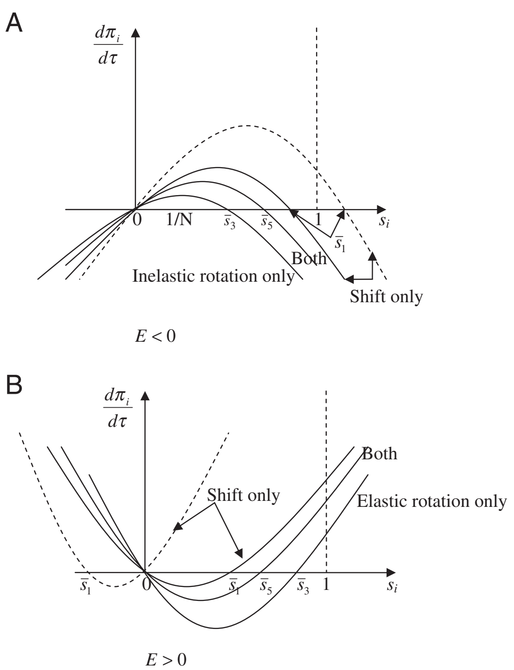

Figure 2. Graphical illustration of effect of τ on an individual firm's profit

so a firm's profit increases with τ if and only if its size is larger than $\bar{s}_1$. Figure 2b graphically illustrates the case of $E > 0$ under the curves denoted as "shift only." If $1 < E < 2$, the number of firms with a share in the range of $s_i > \bar{s}_1$ is also never zero.

We summarize the preceding discussion in the following proposition.

Proposition 1. *(A parallel demand increase) For a sufficiently convex (concave) demand curve, a firm's equilibrium profit increases with τ if and only if its size is sufficiently large (small).*

Formal proofs of all propositions are in online supplementary material. The intuition of proposition 1 is that a convex demand curve does not penalize large firms' production expansion as much as a concave demand curve does. A parallel demand increase always results in an increase in industry output. As industry output expands, the absolute value of P_Q does not change for a linear demand curve, but decreases for a convex demand curve and increases for a concave demand curve. This means industry output expansion will have decreasing downward pressure on the industry price for a convex demand curve and will have increasing downward pressure on the industry price for a concave demand curve. For a sufficiently convex demand curve, large firms will expand production to a point where the net industry price decreases with τ, causing profits of those smallest, most inefficient firms to decrease with τ. However, for a sufficiently concave demand curve, only sufficiently small firms can profitably expand production because a large firm's production expansion will heavily penalize the industry price.

Both Seade (1985) and Février and Linnemer (2004) noted that a cost shock in isolation favors inefficient firms under a convex demand curve.[6] This can be seen here by assuming $P_\tau = 0$. In a model in which a cost shock has no effect on demand, Février and Linnemer (2004) found that the average profit impact of an increase in marginal cost is (using our notation) $-s_i NE + 2E - 2$, which is a special case of our net price impact assuming the assessment does not affect demand. Since generic advertising aims to induce a price increase that is larger than the related cost increase, i.e., $P_\tau > 1$, the consequences of demand convexity in this case are opposite to those in the case of a pure cost shock. As we have seen above with generic advertising, a parallel demand increase favors large (small) firms when demand is convex (concave).

We now consider the effects of generic advertising τ on the industry aggregate profit and on welfare. We find (in online supplementary material) that the consumer surplus effect is always positive. For $E \geq 2/(2-N)$, the industry profit increases with τ; for $E < 2/(2-N)$, the industry profit increases with τ if and only if market concentration satisfies $H < \bar{s}_1$, and the social welfare increases with τ if and only if $H < \bar{s}_2$, where $\bar{s}_2 = [2(E-1) - N]/(NE)$ is the only, positive solution to zero welfare effect with respect to H. It is also worth noting that by equations (10) and (11) the industry profit and welfare effects increase with E for $H > 2/N$ and decrease with E for $H < 2/N$. Proposition 2 sums up the industry and welfare effects.

Proposition 2. *(A parallel demand increase) Consumer surplus always increases with τ. The industry profit increases with τ unless the demand curve is sufficiently concave and market concentration is sufficiently high.*

Since demand expansion is parallel, a higher equilibrium output necessarily leads to an increase in consumer surplus. For $1 < E < 2$, only certain large firms' profits increase with τ. Production shifts from the smaller, inefficient firms to larger, more efficient firms and the market becomes more concentrated. However, since the overall industry becomes more efficient in production, the profit gains of the large firms will more than offset the losses of the small firms, resulting in an increase in the industry profit. For a sufficiently concave demand curve with $E < 2/(2-N)$, only certain small firms' profits increase with τ. To increase the industry profit, there must be enough small firms so that their profit gains will more than offset the losses to the large firms. For $2/(2-N) \leq E \leq 1$, the assessment raises consumer surplus and all firms' profits. The various effects of τ on individual firm's profit, market share, and the aggregate market are reported in tables 1 and 2.[7]

Demand Rotation

In the second scenario, we consider, where $P_\tau = 1$ at the initial equilibrium point and $P_{Q\tau} \neq 0$, $P - \tau$ rotates through the initial equilibrium point (figure 1b). The individual firm's profit effect is:

$$\frac{d\pi_i}{d\tau} = \frac{s_i[QP_{Q\tau}(s_i N + s_i - 2)]}{-\Omega/(QP_Q)} \qquad (14)$$

which is a quadratic function of firm size that passes through the origin regardless of the degree of demand convexity. For an elastic demand rotation ($P_{Q\tau} > 0$), large firms benefit disproportionately. The individual firm's profit

[6] The intuition is as follows. A cost shock reduces the industry output, which will have a decreasing (increasing) upward effect on the industry price for a concave (convex) demand curve. Therefore, a cost shock for a concave demand will reduce the net industry price (the industry price net of the cost shock), inducing a potential loss to some small firms' profits. However, for a sufficiently convex demand curve, a cost shock can reduce the industry output to a point where the net industry price increases, which is commonly known as tax over-shifting when the cost shock is a tax increase. When the net industry price increases, relative efficiency (relative profit margin) among firms decreases, which is more beneficial to less efficient firms (see equation (7)).

[7] Since a linear demand curve is commonly seen in the literature and most generic advertising evaluation studies find the demand effects of generic advertising are tiny, the scenario of parallel demand increase with a linear demand curve (scenario 1, $E = 0$ in tables 1 and 2) indicates representative size of equilibrium adjustments. For example, the net price effect in this case is $(P_\tau - 1)/(1 + N)$, which is 0.25 for $P_\tau = 2$ and $N = 3$. That is, for an oligopoly with three firms, only one-eighth of the advertising-induced partial price increase translates to a net price increase.

Table 1. The Effects of τ on an Individual Firm's Profit and Market Share

Demand curve convexity	Shape of $d\pi_i/d\tau$ as a function of s_i	Sign of $d\pi_i/d\tau$	If $d\pi_i/d\tau > 0$, advertising benefits disproportionately to	Sign of $ds_i/d\tau$
Scenario 1: A parallel demand increase ($P_\tau > 1$ at all prices, $P_{Q\tau} = 0$)				
$E < 2/(2-N)$	Inverse U shape	+ iff $s_i < \bar{s}_1$	Small firms	+ iff $s_i < 1/N$
$2/(2-N) \le E < 0$	Inverse U shape	+	Small firms	+ iff $s_i < 1/N$
$E = 0$	Linear	+	All firms benefit proportionately	+ iff $s_i < 1/N$
$0 < E < 1$	U shape	+	Large firms	+ iff $s_i < 1/N$
$E = 1$	U shape	+	Large firms	0
$1 < E < 2$	U shape	+ iff $s_i > \bar{s}_1$	Large firms	+ iff $s_i > 1/N$
Scenario 2a: An elastic demand rotation alone ($P_\tau = 1$ at the initial equilibrium, $P_{Q\tau} > 0$)				
$\forall E$	U shape	+ iff $s_i > \bar{s}_3$	Large firms	+ iff $s_i > 1/N$
Scenario 2b: An inelastic demand rotation alone ($P_\tau = 1$ at the initial equilibrium, $P_{Q\tau} < 0$)				
$\forall E$	Inverse U shape	+ iff $s_i < \bar{s}_3$	Small firms	+ iff $s_i < 1/N$
Scenario 3: An elastic demand increase ($P_\tau \ge 1$ at all prices, $P_{Q\tau} > 0$)				
$E < 0$	Mixed	Mixed	Mixed	Mixed
$E = 0$	U shape	+	Large firms	+ iff $s_i < 1/N$
$0 < E < 2$	U shape	+ iff $s_i > \bar{s}_5$	Large firms	Mixed
Scenario 4: An inelastic demand increase ($P_\tau \ge 1$ at all prices, $P_{Q\tau} < 0$)				
$E \le 0$	Inverse U shape	+ iff $s_i < \bar{s}_5$	Small firms	+ iff $s_i < 1/N$
$E = 0$	Inverse U shape	+ iff $s_i < \bar{s}_5$	Small firms	+ iff $s_i < 1/N$
$0 < E < 2$	Mixed	Mixed	Mixed	Mixed

Note: Iff means "if and only if," $\bar{s}_1 = 2(E-1)/(NE)$, $\bar{s}_2 = [2(E-1)-N]/(NE)$, $\bar{s}_3 = 2/(N+1)$, $\bar{s}_4 = \{(1+N-E)/(Q^2 P_{Q\tau})[\int_0^Q [\int_0^z P_{Q\tau}(u,\tau)du - \int_0^Q P_{Q\tau}(u,\tau)du]dz] + 1]\}/(N+1)$, $\bar{s}_5 = 2[(P_\tau - 1)(E-1) + QP_{Q\tau}]/[(P_\tau - 1)NE + QP_{Q\tau}(N+1)]$ (the positive solution to equation (9) being zero), and $\bar{s}_6 = \{(1+N-E)Q\int_0^Q [P_\tau(Q,\tau) - P_\tau(z,\tau)]dz + [(P_\tau - 1)(2E-2-N) + QP_{Q\tau}\}/[(P_\tau - 1)NE + QP_{Q\tau}(N+1)]$ (the solution to the sum of equations of (10) and (11) being zero, with respect to H). For $E > 0$ and $P_{Q\tau} > 0, \bar{s}_1 < \bar{s}_5 < \bar{s}_3 < 1$ holds; for $E < 0$ and $P_{Q\tau} < 0, 1/N < \bar{s}_3 < \bar{s}_5 < \bar{s}_1 < \bar{s}_2$ holds.

effect is positive if and only if the firm's size exceeds a threshold, $\bar{s}_3 = 2/(N+1)$. Although $\bar{s}_3$ is less than one, there may be no firm that possesses market share in the range of $s_i > \bar{s}_3$ in an asymmetric oligopoly, that is, it is possible that no firm profits from generic advertising if its effect is an elastic demand rotation. In a symmetric oligopoly, all firms' market shares fall below this threshold, and thus no firm finds generic advertising profitable.[8] Similarly, for an inelastic rotation, small firms benefit disproportionately, and the firm's profit effect is positive if and only if its size is less than $\bar{s}_3$, a condition that is always satisfied under symmetry. Thus, in a symmetric market, all firms benefit from an inelastic demand rotation. Figure 2 illustrates the individual firm's profit effect for cases of elastic and inelastic demand rotations.

Proposition 3. *(A demand rotation alone) An elastic demand rotation increases a firm's profit if and only if its size exceeds $2/(N+1)$; an inelastic demand rotation increases a firm's profit if and only if its size falls below $2/(N+1)$.*

The economic intuition behind proposition 3 is the following. An elastic demand rotation puts downward pressure on the industry-wide price-cost margin, shifting production from below average-size firms to above average-size firms and resulting in an increase in market concentration. Only sufficiently large firms, in other words those sufficiently efficient firms, can profitably adjust to the downward pressure. For an inelastic demand rotation, output expansion of large firms will have more significant downward pressure on the industry price exactly because the industry demand becomes more inelastic. Only sufficiently small firms therefore can profitably expand production, shifting production from firms with size above average to the firms with size below average and reducing the market concentration. By aggregating equation (14) over i, we find that an elastic (inelastic) demand rotation increases the industry profit if and only if the Herfindahl-Hirschman index exceeds (falls below) $2/(N+1)$. The consumer surplus

[8] Note that $1/N - 2/(N+1) = (1-N)/[N(N+1)] < 0$.

Table 2. The Effects of τ on the Industry and Welfare

Demand curve convexity	Sign of $dQ/d\tau$	Sign of $dP/d\tau - 1$	*Asymmetric Case* Sign of $dH/d\tau$	*Asymmetric Case* Sign of $dCS/d\tau$	*Asymmetric Case* Sign of $d\Pi/d\tau$	*Asymmetric Case* Sign of $dW/d\tau$	*Symmetric Case* Sign of $dCS/d\tau$	*Symmetric Case* Sign of $d\Pi/d\tau$	*Symmetric Case* Sign of $dW/d\tau$
Scenario 1: A parallel demand increase ($P_\tau > 1$ at all prices, $P_{Q\tau} = 0$)									
$E < 2/(2-N)$	+	+	−	+	+ iff $H < \bar{s}_1$	+ iff $H < \bar{s}_2$	+	+	+
$2/(2-N) \leq E < 0$	+	+	−	+	+	+	+	+	+
$E = 0$	+	+	−	+	+	+	+	+	+
$0 < E < 1$	+	+	−	+	+	+	+	+	+
$E = 1$	+	0	0	+	+	+	+	+	+
$1 < E < 2$	+	−	+	+	+	+	+	+	+
Scenario 2a: An elastic demand rotation alone ($P_\tau = 1$ at the initial equilibrium, $P_{Q\tau} > 0$)									
$E = 0$	+	−	+	−	+ iff $H > \bar{s}_3$	+ iff $H > \bar{s}_4$	−	−	−
$E \neq 0$	+	−	+	+ iff (15) >0	+ iff $H > \bar{s}_3$	+ iff $H > \bar{s}_4$	+ iff (15) >0	−	+ iff $H > \bar{s}_4$
Scenario 2b: An inelastic demand rotation alone ($P_\tau = 1$ at the initial equilibrium, $P_{Q\tau} < 0$)									
$E = 0$	−	+	−	+	+ iff $H < \bar{s}_3$	+ iff $H < \bar{s}_4$	+	+	+
$E \neq 0$	−	+	−	+ iff (15) >0	+ iff $H < \bar{s}_3$	+ iff $H < \bar{s}_4$	+ iff (15) >0	+	+ iff $H < \bar{s}_4$
Scenario 3: An elastic demand increase ($P_\tau \geq 1$ at all prices, $P_{Q\tau} > 0$)									
$E < 0$	+	Mixed	Mixed	+ iff (11) >0	Mixed	Mixed	Mixed	Mixed	Mixed
$E = 0$	+	+	−	+	+	+	+	+	+
$0 < E < 2$	+	Mixed	Mixed	+ iff (11) >0	+ iff $H > \bar{s}_5$	+ iff $H > \bar{s}_6$	Mixed	Mixed	Mixed
Scenario 4: An inelastic demand increase ($P_\tau \geq 1$ at all prices, $P_{Q\tau} < 0$)									
$E < 0$	Mixed	+	−	+ iff (11) >0	+ iff $H < \bar{s}_5$	+ iff $H < \bar{s}_6$	Mixed	+	Mixed
$E = 0$	Mixed	+	−	+	+ iff $H < \bar{s}_5$	+ iff $H < \bar{s}_6$	+	+	+
$0 < E < 2$	Mixed	Mixed	Mixed	+ iff (11) >0	Mixed	Mixed	Mixed	+	Mixed

Note: values of $\bar{s}_1 - \bar{s}_6$ are reported in the note of table 1.

effect and welfare effects for a demand rotation alone are:

$$(15)\quad \frac{dCS}{d\tau} = \int_0^Q \left[\int_0^z P_{Q\tau}(u,\tau)du - \int_0^Q P_{Q\tau}(u,\tau)du\right]dz + \frac{QP_{Q\tau}}{-\Omega/(QP_Q)}$$

and

$$(16)\quad \frac{dW}{d\tau} = \int_0^Q \left[\int_0^z P_{Q\tau}(u,\tau)du - \int_0^Q P_{Q\tau}(u,\tau)du\right]dz + \frac{QP_{Q\tau}(HN+H-1)}{-\Omega/(QP_Q)}.$$

Since $\Omega = -P_Q(1+N-E)$, the consumer surplus effect depends crucially on two factors—$P_{Q\tau}$ and E. The consumer surplus effect consists of two opposing parts. For an elastic demand rotation, the whole integration term is negative and the last term, which is increasing in E, is positive. Therefore, a larger E makes it more likely for consumer surplus to increase with τ. The reverse is true for an inelastic demand rotation. Let $\bar{s}_4$ (reported in table 1 to save space) be the only, positive H that solves $dW/d\tau = 0$ (see equation (16)). Then an elastic (inelastic) demand rotation increases welfare if and only if the Herfindahl-Hirschman index exceeds (falls below) $\bar{s}_4$. The conditions for a positive consumer surplus or welfare effect are simple for a linear demand. The effect on consumer surplus (equation (15)) reduces to $Q^2P_{Q\tau}[-1/2 + 1/(1+N)]$, which is negative for an elastic demand rotation and positive for an inelastic demand rotation. The welfare effect in this case is $Q^2P_{Q\tau}[H - 1/2 - 1/(1+N)]$, which for an elastic demand rotation is positive if and only if $H > 1/2 + 1/(1+N)$.

We have shown that for a parallel demand increase, the industry output expands and consumer surplus always increases. However, advertising that makes demand more elastic will lead to an expansion in industry output, a decrease of the net price, and yet possibly to a decrease in consumer surplus (see table 2, scenario 2a). The reason for this seemingly paradoxical result is that a demand rotation only changes the spread of the probability distribution function of the willingness to pay (see Johnson and Myatt 2006; Zheng, Kinnucan, and Kaiser 2010, for graphical illustration and explanations of demand curve rotation). An elastic demand rotation increases the willingness to pay of consumers in the lower part of the distribution (whose willingness to pay was low) and at the same time decreases the willingness to pay of consumers in the higher end of the distribution. In a Cournot model, the latter effect may dominate even though the industry output expands overall, resulting in a consumer surplus loss.

We have identified conditions under which small firms indeed benefit less than large firms and possibly even lose from generic advertising, namely when demand is sufficiently convex and the shift is parallel, or with an elastic demand rotation. In these cases, production shifts from less to more efficient producers. In the parallel shift case this results in higher social welfare, and in the elastic rotation case it results in higher welfare if the market is sufficiently concentrated. In reality, generic advertising could affect market demand through any combination of demand shift and rotation. In this study, we choose two representative combinations to discuss.

Elastic or Inelastic Demand Increase (Expansion)

An elastic demand increase, where $P_\tau \geq 1$ at all prices and $P_{Q\tau} > 0$, describes the case in which advertising induces demand to grow at all prices, but it brings in consumers who are more price sensitive than the preceding ones. This is referred to as the "extending reach" case in Pepall, Norman, and Richards (2008). An inelastic demand increase arises when $P_\tau \geq 1$ and $P_{Q\tau} < 0$, and is referred to as the "building value" cases of advertising in Pepall, Norman, and Richards (2008) (see figures 1c and 1d). We consider three scenarios of demand expansion: the parallel demand shift, the elastic demand expansion, or the inelastic demand expansion. In all three cases, demand increases for every price. We ask: which of these is best in terms of industry profit and in terms of welfare? Let the price increases at the initial equilibrium point be equal in all the three scenarios (i.e., $P_\tau - 1$ is the same). If the Herfindahl-Hirschman index exceeds $2/(N+1)$, then the ranking of the industry profit effect, from the highest to the lowest, is: elastic demand increase, parallel demand increase, and inelastic demand increase. The ranking is reversed if the Herfindahl-Hirschman index falls below $2/(N+1)$. We obtain the following proposition.

Proposition 4. *For a sufficiently concentrated industry ($H > 2/(N+1)$), an elastic demand expansion increases industry profit more than a comparable (i.e., with the same $P_\tau - 1$ at the initial equilibrium) parallel demand shift and inelastic demand expansion. For a sufficiently low concentration industry ($H < 2/(N+1)$), an inelastic demand expansion increases industry profit more than a comparable parallel demand shift and elastic demand expansion.*

Proposition 4 suggests that for highly concentrated industries (assuming costs are equal), an elastic expansion (an elastic rotation and a shift) is best from an industry perspective. Similarly, for sufficiently low concentration industries, from an industry perspective an inelastic expansion is best. Such result implies that, depending on the market concentration of the industry, a generic advertising message that makes the underlying commodity more like a mass or niche commodity can be profit enhancing. The same result as in proposition 4 also applies to social welfare (see online supplementary material for proof of proposition 4).

Interestingly, for a linear demand curve, any demand expansion always increases consumer surplus, and an elastic demand expansion always increases the industry profit (see online supplementary material). Another special case we investigated is that of a symmetric oligopoly, where $H = 1/N < 2/(N+1)$. Hence, by proposition 4, from an industry perspective as well as from a welfare point of view, inelastic demand expansions are best. Table 2 summarizes our findings for the various effects of τ for a symmetric oligopoly.

Connection to Relevant Studies

Both Crespi and Marette (2002) and Chakravarti and Janiszewski (2004) found that for a differentiated product, generic advertising is not truly generic—it may help low-quality producers while hurting high-quality producers. Our theoretical examinations show that, even for a homogeneous product, generic advertising does not benefit producers equally—it may help only the largest (or the smallest) producers while hurting the rest of the industry.

A disproportionate distribution of generic advertising benefits can arise due to any one, or a combination, of the following three sources: (1) a demand shift with heterogeneous slopes of the marginal cost curves; (2) a demand shift for a nonlinear demand curve under imperfect competition; and (3) a demand rotation under imperfect competition. Assuming a linear marginal cost but a linear demand curve and no advertising-induced demand rotation, Chung and Kaiser (2000a; 2000b) addressed the first source of disproportionate benefits in an oligopoly and in a perfectly competitive market, and found that in both cases generic advertising disproportionately benefits firms with smaller supply response to price, i.e., smaller $c_i/(q_i \partial c_i/\partial q_i)$. Since the authors find empirical support in the literature that smaller firms have smaller supply response, they conclude smaller firms benefit disproportionately, which does not explain the concerns that are often raised that small firms are disadvantaged by generic advertising. Generic advertising also cannot decrease a firm's profit since demand rotation and strict convexity are assumed away. Although more restrictive on the cost side, our study identified and addressed the latter two sources of disproportionate benefits under imperfect competition. Our model helps explain the small firms' concerns. Note that no neat classificatory results seem to emerge for a model that considers all the three sources of disproportionate benefits. For a flat marginal cost curve, Chung and Kaiser's (2000a) results reduce to the case of $E = 0$ in our scenario of a parallel demand shift.

For a symmetric oligopoly, Quirmbach (1988) argued that for advertising to be profitable, it should not only expand demand but also make demand less elastic because an inelastic demand increase increases the industry profit while an elastic demand increase does not necessarily do so. Our analysis identifies the condition in which an elastic or an inelastic demand increase is preferred (from both the industry and social perspectives) in an asymmetric oligopoly. For a sufficiently concentrated industry, generic advertising should not only expand demand but also make demand *more* elastic, from both the industry and social perspectives. To make demand more elastic, an advertisement can stress a product's homogeneous attributes or substitutability for other products. An advertisement of "Eggs: the Perfect Protein" might make the demand more elastic since many other food products are good sources of protein. On the other hand, for an industry with sufficiently low concentration, generic advertising should not only expand demand but also make demand more inelastic. To make the demand more inelastic, an advertising campaign can emphasize a product's uniqueness, e.g., milk's contribution to weight loss (Zheng, Kinnucan, and Kaiser 2010).

Our article analyzed the welfare effect of generic advertising, which was not addressed in the aforementioned studies on generic advertising. We have shown that a parallel demand increase will always increase consumer surplus. Hence, if industry profits increase, social welfare must increase. However, a decline in welfare can arise when advertising results in a demand rotation. Take an industry with a linear demand curve, for example. If the Herfindahl-Hirschman index is in the range of $[2/(N+1), 1/2+1/(N+1)]$, that is, $\bar{s}_3 < H < \bar{s}_4$, an elastic demand rotation alone increases the industry profit but decreases consumer surplus and social welfare. If the Herfindahl-Hirschman index is greater than $1/2+1/(N+1)$, an inelastic demand rotation alone increases consumer surplus but decreases the industry profit and social welfare. In both examples above, the gain from one side, either consumers or producers, is not enough to offset the loss from the other side, leading to a net welfare loss. Another extreme example of inefficient advertising arises in the case of a symmetric oligopoly facing a linear demand curve. An elastic demand rotation reduces both consumer surplus and total producers' profits.

Extensions and Implications of the Model

A Market with a Large Number of Firms

One might wonder to what extent our results extend to certain agricultural markets where a large number of producers exist. To address this, we consider a market with two types of firms competing according to Cournot competition—efficient firms with a lower constant marginal cost and inefficient firms with a higher constant marginal cost. Symmetry is imposed among all firms of the same type to make results generalizable (see Hamilton 1999 for similar treatment). Using a linear demand function as an illustration, we show that in the limit, as the number of inefficient firms goes to infinity, an inefficient firm's production approaches zero and the firm makes zero profit (see online supplementary material). An efficient firm makes a positive profit. An elastic demand rotation alone will result in an increase in efficient (large) firms' profits, a decrease in inefficient firms' group market share, but no change in inefficient firms' profits (as these will remain zero in the limit). On the other hand, a parallel demand increase will not have an effect on firms' profitability but will increase the group share of small (inefficient) firms.

Free Entry

We acknowledge that our analysis assumes an exogenous number of firms, and hence our results are contingent upon entry and exit being held to zero. In the same setting as above, we also relax the assumption of no entry/exit by allowing for free entry of inefficient firms. Here we assume each small firm has a fixed cost $F > 0$. We find that a parallel demand increase or an inelastic demand rotation alone induces entry (of inefficient firms), and an elastic demand rotation alone induces exit. Overall, our finding that an elastic demand rotation is largely beneficial to large (efficient) firms does not hinge on our assumptions of an exogenously given number of firms.[9]

Evaluating Generic Advertising Programs

One implication of our article is that for imperfectly competitive markets, demand rotation could be a part of effectiveness evaluation of generic advertising programs. Since 1990, all federal promotion programs with mandatory assessments have been required by law to be independently evaluated every five years. The focus of the mandated evaluations has mainly remained on advertising elasticity without demand rotation. Empirical studies suggest that, in practice, the effect of generic advertising might not be a simple demand shift. For example, Zheng, Kinnucan, and Kaiser (2010) found that generic fluid-milk advertising rotated demand clockwise, which largely fits into our classification of an inelastic demand rotation. Such advertising may be beneficial to fluid-milk processors if the processor market concentration is not high.

[9] Free exit itself may offer a simpler explanation for small producers' opposition to mandatory assessment. Smaller firms usually have higher marginal costs. A mandatory assessment raises all firms' variable costs; however, it places smaller firms at greater risk of shutting down due to adverse price swings.

Small Firm Exemption from Generic Advertising Programs

As we showed earlier, there are conditions under which mandatory generic advertising favors large firms, and small firms could actually suffer losses from participation. A number of existing generic advertising programs exempt smaller firms from paying assessments. For example, when the aforementioned fluid-milk processors started their mandated assessment in 1996, only processors marketing 500,000 pounds or more per month were required to pay the unit assessment. That is, the industry raised the assessment for large firms and allowed small firms to free-ride. Where to draw the cut-off line is a significant concern for legislators, marketing boards, and stakeholders, but has not yet been formally addressed.

A slight modification of our model allows a marketing board to evaluate the effect on the industry's profit of increasing the assessment for large firms at different cut-off points. Let $j = 1, 2$ index the two subgroups, a large-firm group and a small-firm group, respectively. Before the assessment, group j has N_j firms, produces an output of Q_j, has a group market share of w_j, and faces a unit assessment of $\tau_j (\tau_1 = \tau_2 = 0)$. Let $N_1 + N_2 = N, Q_1 + Q_2 = Q$, and $w_1 + w_2 = 1$. The effect of τ_1 on industry profits is derived in online supplementary material and is given by

$$\frac{d\Pi}{d\tau_1} = \frac{\begin{array}{c}(w_1 P_\tau - 1)(HNE - 2E + 2) \\ + w_1 Q P_{Q\tau}(HN + H - 2) + 2w_2 \\ (1 + N - E) + N_2(HE - 2)\end{array}}{-\Omega/(QP_Q)}. \tag{17}$$

Equation (17) identifies the condition under which an industry can profitably raise the assessment for a group of larger firms while exempting smaller firms. We see that the effect on industry profit depends crucially on the number of exempt smaller firms and on each group's market share (N_2, w_1, and w_2, respectively). Note that the policy choice presented by the cut-off point reduces to the value of N_2 (which, given initial market shares, determines w_1 and w_2). Using equation (17), we can find the largest number of firms that can be exempt from the assessment while still maintaining an overall increase in industry profit. From the industry's perspective, a cut-off line that yields a negative industry profit effect should not be chosen.

Take $N = 8$ and a linear demand curve of $P = 20 + 5\tau - Q + 0.1\tau Q$ as an example, where $\tau < 1$. Assume industry output of $Q = 10$ and that the eight firms have market shares of 0.4, 0.4, 0.1, 0.04, 0.02, 0.02, 0.01, and 0.01, respectively. Therefore, $H = 0.33$. Since $P_\tau = 6$, and $P_{Q\tau} = 0.1$ at the initial equilibrium point, this is a scenario of an elastic demand increase. We evaluate $d\Pi/d\tau_1, dCS/d\tau_1$, and $dW/d\tau_1$ for $N_2 = 0, \ldots, 7$. It turns out that $N_2 = 0$ yields the largest social welfare, with the three effects being 12.19, 40.56, and 52.74. For $N_2 = 5$, the three effects are 1.64, 41.17, and 42.80. Finally, for $N_2 = 6$, the three effects are –0.03, 37.33, and 37.31. This is because the two largest firms' profits begin to decrease with τ_1 when the number of firms that free-ride exceeds five. Therefore, N_2 cannot exceed five from the industry's perspective. The largest firm's share among the small-firm group is 0.04, which should be used to define the upper limit of the "smaller" firms that are allowed to free-ride, identifying the upper limit of the cut-off point. However, from the social perspective, no firm should be exempted.

Conclusion

We theoretically investigate how benefits of mandated generic advertising vary with firm size in an asymmetric Cournot oligopoly market with a focus on unit-assessment funding. We find that the effect of such a program on an individual firm's profit depends on the nature of the change in market demand, and also on the firm's market share. We identify situations in which generic advertising disproportionately favors large (or small) firms and decreases profits. Generic advertising benefits larger firms more in one of the following three situations: a demand shift for convex demand, an elastic demand rotation, or an elastic demand expansion of a convex demand. We find that not all firms consistently benefit from advertising-induced demand expansion. In some circumstances, only firms for which market share exceeds a given threshold benefit from generic advertising, and in other cases only firms for which market share falls below a threshold benefit. Such findings help explain the concerns which are often raised that small firms are disadvantaged by generic advertising and cast doubt on the fairness of mandated generic advertising programs in markets with imperfect competition.

We also study the welfare effects of a mandatory advertising program by identifying situations in which generic advertising improves the industry profit, consumer surplus, and social welfare. Advertising may increase consumer surplus as it expands demand. Even if market concentration increases, since larger firms are, in the asymmetric Cournot model, also the more efficient ones, generic advertising may increase production efficiency by shifting production from smaller (less efficient) firms to larger ones. However, depending on the nature of shift in demand and on the curvature of the demand function, generic advertising could also result in a decrease in social welfare even if it expands demand at all price levels.

Our study has a variety of implications. For example, for an industry with sufficiently high (low) concentration, generic advertising would be more beneficial if it not only expands demand but also makes demand more (less) elastic. We also suggest that for imperfectly competitive markets, demand rotation should be a part of effectiveness evaluation of generic advertising programs.

Finally, we note a limitation of our model, and a possible direction for future work. Our analysis compares generic advertising to a benchmark situation with no advertising. This seems reasonable for situations where (due to the free-rider problem) absent such a campaign no firm has strong enough private incentives to engage in generic advertising. If some firms (likely large ones) engage in private advertising campaigns, establishing a generic advertising could result in a decline in private contributions to advertising.

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Supplementary Material

Supplementary material is available at the *American Journal of Agricultural Economics* online at www.oxfordjournals.org/our_journals/ajae/.

References

Chakravarti, A., and C. Janiszewski. 2004. The Influence of Generic Advertising on Brand Preferences. *Journal of Consumer Research* 30: 487–502.

Chung, C., and H. M. Kaiser. 2000a. Distribution of Generic Advertising Benefits across Participating Firms. *American Journal of Agricultural Economics* 82: 659–64.

———. 2000b. Do Farmers Get an Equal Bang for Their Buck from Generic Advertising Programs? A Theoretical and Empirical Analysis. *Journal of Agricultural and Resource Economics* 25: 147–58.

Crespi, J. M., and S. Marette. 2002. Generic Advertising and Product Differentiation. *American Journal of Agricultural Economics* 84: 691–701.

Dixit, A. 1986. Comparative Statics for Oligopoly. *International Economic Review* 27: 107–22.

Farrell, J., and C. Shapiro. 1990a. Asset Ownership and Market Structure in Oligopoly. *The Rand Journal of Economics* 21: 275–92.

———. 1990b. Horizontal Mergers: An Equilibrium Analysis. *American Economic Review* 80: 107–26.

Février, P., and L. Linnemer. 2004. Idiosyncratic Shocks in an Asymmetric Cournot Oligopoly. *International Journal of Industrial Organization* 22: 835–48.

Forker, O. D., and R. W. Ward. 1993. *Commodity Advertising: The Economics and Measurement of Generic Programs*. New York, NY: Lexington Books.

Glickman v. Wileman Brothers & Elliott, Inc. [1997]. 117 Sup. Ct. 2130, 138 L. Ed. 2d 585, 95–1184.

Hamilton, S. F. 1999. Demand Shifts and Market Structure in Free-Entry Oligopoly Equilibria. *International Journal of Industrial Organization* 17: 259–75.

Johnson, J. P., and D. P. Myatt. 2006. On the Simple Economics of Advertising, Marketing, and Product Design. *American Economic Review* 96: 756–84.

Kaiser, H. M., and N. Suzuki, eds. 2006. *New Empirical Industrial Organization and the Food System*. New York: Peter Lang Publishing.

Kawaguchi, T., N. Suzuki, and H. M. Kaiser. 2001. Evaluating Class I Differentials in the New Federal Milk Marketing Order System. *Agribusiness* 17: 527–38.

———. 1997. A Spatial Equilibrium Model for Imperfectly Competitive Milk Markets. *American Journal of Agricultural Economics* 79: 821–59.

Kilman, S. 2006. Smithfield to Buy Hog Farmer Premium Standard. *The Wall*

Street Journal, 19 September, page A.12.
Madhavan, A. N., R. T. Masson, and W. H. Lesser. 1994. Cooperation for Monopolization? An Empirical Analysis of Cartelization. *The Review of Economics and Statistics* 76: 161–75.
Pepall, L., G. Norman, and D. Richards. 2008. Generic Product Advertising, Spillovers, and Market Concentration. *American Journal of Agricultural Economics* 90: 719–32.
Quirmbach, H. C. 1988. Comparative Statics for Oligopoly: Demand Shift Effects. *International Economic Review* 29: 451–9.
Seade, J. 1985. Profitable Cost Increases and the Shifting of Taxation: Equilibrium Responses of Markets in Oligopoly. Mimeo, University of Warwick.
Spulber, D. F. 2004. *Management Strategy*. New York: McGraw-Hill.
The Kiplinger Agriculture Letter. 2001. Government Commodity Checkoffs. 26 January. Available at http://www.encyclopedia.com/doc/1G1-93265578.html; accessed 1 August 2008.
The New York Times. 2003. Unconstitutional Farm Checkoffs. 1 November, page 14. Available at http://query.nytimes.com/gst/fullpage.html?res=9903E4D71230F932A35752C1A9659C8B63#; accessed 1 August 2008.
United States v. United Foods, Inc. [2001]. 533 U.S. 00-276.
Vives, X. 1999. *Oligopoly Pricing: Old Ideas and New Tools*. Cambridge, MA: MIT Press.
Ward, R. W. 2006. Commodity Checkoff Programs and Generic Advertising. *Choices: The Magazine of Food, Farm, and Resource Issues* 21: 55–60.
Zheng, Y, H. W. Kinnucan, and H. M. Kaiser. 2010. Measuring and Testing Advertising-induced Rotation in the Demand Curve. *Applied Economics* 42: in press. Available at SSRN: http://ssrn.com/abstract=1026596; accessed 1 August 2008.