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Strategic Advertising Policy in International Oligopoly Markets

Elizabeth Schroeder and Victor J. Tremblay

Oregon State University, Corvallis, Oregon, USA

ABSTRACT

Strategic trade policy has become an important tool used by countries to increase domestic welfare. Ma and Ulph (2012) further this discussion by analyzing strategic advertising policy in international oligopoly markets. They find that it is always optimal for a home government to subsidize advertising for exports, whether firms compete in a Cournot- or Bertrand-type game. By extending their analysis to include the Cournot-Bertrand model, we find that an advertising subsidy is not always optimal for the home country. In some cases, the optimal strategic policy is an advertising tax.

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I. Introduction

Strategic trade policy has become an important, if controversial, tool used by countries to increase domestic welfare. Formal analysis of this issue uses the third-country model, where a firm from a home country competes with another firm from a foreign country for customers in a third country. These firms are the only suppliers to the third country. The policy question is whether or not the home country can increase welfare by subsidizing its home (exporting) firm.

The traditional literature shows that the answer can depend on the mode of competition. In the product market, Brander and Spencer (1985) showed that a subsidy is optimal if firms compete in a Cournot-type game, while Eaton and Grossman (1985) showed that tax is optimal if firms compete in a Bertrand-type game. More recently, Ma and Ulph (2012) investigated the welfare effect of an advertising subsidy/tax on the home firm. They considered both cooperative and predatory forms of advertising and found that an advertising subsidy is optimal for both forms of advertising and in both Cournot and Bertrand settings.

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CONTACT Elizabeth Schroeder ✉ liz.schroeder@oregonstate.edu 🖃 Department of Economics, Oregon State University, 303 Ballard Extension Hall, Corvallis, OR, 97331, USA

A major weakness of these studies is that they consider only two modes of competition. Schroeder and Tremblay (forthcoming) consider an additional possibility, the Cournot-Bertrand model,[1] where one firm competes in output (*à la* Cournot) and the other competes in price (*à la* Bertrand). By allowing for Cournot, Bertrand, and Cournot-Bertrand behavior, Schroeder and Tremblay show that the optimal policy in the product market does not depend on the mode of competition. It only depends on the strategic choice of the foreign firm. Regardless of the strategic choice of the home firm (output or price), an output subsidy is optimal when the foreign firm competes in output and an output tax is optimal when the foreign firm competes in price.

In this article, we use this broader framework to identify the optimal subsidy/tax policy on advertising. By giving firms a more complete set of strategic options, we show that an advertising subsidy is not always welfare-improving. What is optimal is for the home country to choose a policy that encourages the foreign firm to spend more on cooperative advertising and less on predatory advertising. In some cases, this involves a tax on home firm advertising.

II. Advertising in Cournot, Bertrand, and Cournot-Bertrand models

We consider the same three-stage game and use the same notation as Ma and Ulph (2012). Two firms in different countries export imperfect substitutes to a third country. One firm (firm i) is an export supplier, and its home country (country i) has the option of imposing an export subsidy or tax on its home firm's advertising. In the first stage of the game, the home government sets τ, which is an advertising subsidy when τ > 0 and is an advertising tax when τ < 0. The goal is to choose the level of τ that maximizes home country welfare. In the second stage, firms compete by simultaneously choosing the level of advertising. In the final stage, firms compete in the product market. Backwards induction is used to identify the subgame-perfect Nash equilibrium to this game. In this section, we analyze equilibria in stages two and three. We investigate the optimal advertising subsidy for stage one in the next section.

In the final stage, four different modes of competition are possible. These are described in Figure 1. When both firms compete in output, there is a Cournot game; when both firms compete in price, there is a Bertrand game. These cases are described in the northwest and southeast corners of Figure 1. Other possibilities include games with strategic asymmetries. In the Cournot-Bertrand game, firm 1 competes in output and firm 2 competes in price

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[1]The static Cournot-Bertrand model is discussed in Singh and Vives (1984), Martin (2002, 82), Tremblay and Tremblay (2011, 2012), and Tremblay et al. (2013a), and a dynamic version is discussed in Tremblay and Tremblay (2012), and Tremblay et al. (2013a).

Foreign Firm

		q	p
Home Firm	q	q_h, q_f Cournot	q_h, p_f Cournot-Bertrand
	p	p_h, q_f Bertrand-Cournot	p_h, p_f Bertrand

Figure 1. Static duopoly games and the choice of output (q) or price (p).

(northeast corner). The reverse is true in the Bertrand-Cournot game (south-west corner). Our goal is to provide a more general framework by consider-ing all possibilities.

There are cases where a mix of Cournot-Bertrand behavior is observed in the real world.[2] In the market for small cars, for example, Tremblay et al. (2013b) found that Honda dealers replenish their inventories once a month and allow the price to adjust to meet their sales goals. In contrast, Scion (a Toyota brand) dealers use a pure-pricing policy, where a customer chooses a make of automobile and accessories from a menu of fixed prices. The new car is then delivered to the customer within several weeks. In this case, Honda dealers exhibit Cournot-type behavior and Scion dealers exhibit Bertrand-type behavior. In international trade, the work of Maggi (1996) suggests (1) that firms in low-wage countries may be mass producers that face capacity constraints, making it optimal to compete in output; and (2) that competing firms in high-wage countries may produce custom-made goods, making it optimal to compete in price.

To derive the Cournot-Bertrand outcome in the final stage game, we consider a demand system that derives from Bowley (1924) and Dixit (1979) and was used by Ma and Ulph. If firms were to compete in a Cournot setting, the inverse demands are:

$$p_i(x_i, x_j) = a_i - bx_i - x_j \tag{1}$$

where subscript i represents firm 1 or 2, subscript j represents the other firm, p is price, and x is output. Parameter $b > 1$ indicates the degree of product differentiation. Products are homogeneous when $b = 1$, and the degree of product differentiation increases in b. Parameter a_i is a function of advertis-ing. Following Ma and Ulph (2012; Equation (1));

$$a_i = a\big[1 + \mu(m_i + m_j) + \nu(n_i - n_j)\big] \tag{2}$$

where m represents the level of a firm's cooperative advertising and n represents the level of a firm's predatory advertising. Parameter $a > 0$

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[2]Singh and Vives (1984) show that, given the choice between competing in a symmetric Cournot, Bertrand, or Cournot-Bertrand setting, the dominant choice is Cournot. However, Tremblay et al. (2013a) show that Cournot-Bertrand can be dominant when firms face asymmetric set-up costs. Such an asymmetry motivates Cournot-Bertrand behavior in the market for small cars (Tremblay et al. 2013b).

determines the size of the market, $\mu > 0$ indicates the effectiveness of cooperative advertising, and $v > 0$ indicates the effectiveness of predatory advertising. A distinguishing feature of these types of advertising is that firm i's demand increases with the cooperative advertising of its rival and diminishes with the predatory advertising of its rival.[3]

For a particular mode of competition, the strategic or choice variables must be on the right-hand side of each demand function. In Cournot, the strategic variables are output (x_1 and x_2). In Bertrand, they are prices (p_1 and p_2).[4] In Cournot-Bertrand, where firm i competes in output and firm j competes in price, the strategic variables are x_i and p_j. The Cournot-Bertrand demand system is obtained by solving the system in (1) for p_1 (firm 1's demand) and x_2 (firm 2's demand):

$$p_1(x_1, p_2) = A_1 - B_1 x_1 + G_1 p_2 \qquad (3)$$
$$x_2(x_1, p_2) = A_2 - B_2 p_2 - G_2 x_1,$$

where $A_1 = \frac{a_1 b - a_2}{b}$, $A_2 = \frac{a_2}{b}$, $B_1 = \frac{b^2 - 1}{b}$, $B_2 = G_1 = G_2 = \frac{1}{b} = g$. We can write this more generally for the Cournot-Bertrand and Bertrand-Cournot models as: $y_i(y_i, y_j) = A_i - B_i y_i - G_j y_j$, where firm i is located in the home country and y is the strategic variable. In the Cournot-Bertrand model, $y_i = x_i$ and $y_j = p_j$; in the Bertrand-Cournot model, $y_i = p_i$ and $y_j = x_i$.

Firms do not cooperate, and the goal of each firm is to maximize its own profit. Production costs exhibit constant returns, while marketing costs increase at an increasing rate. Specifically, firm i's total cost is $cx_i + \frac{1}{2}k(m_i + n_i)^2$, where $k > 0$ and c is the marginal cost of production.[5] Thus, firm i's profit is $\pi_i = p_i x_i - cx_i - \frac{1}{2}k(m_i + n_i)^2$. For simplicity, marginal cost is normalized to zero.[6]

At the final stage, the Nash equilibrium for this Cournot-Bertrand game is found in Tremblay and Tremblay (2011). They show that even though firm costs and the demand system in (1) are symmetric, competition over different choice variables leads to an asymmetric Nash equilibrium:

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[3]By definition, firm j's cooperative advertising increases firm i's demand as well as firm j's demand. There is a positive externality associated with firm j's advertising, and cooperative advertising is a strategic complement. With predatory or combative advertising, firm j's advertising increases firm j's demand but decreases firm i's demand. There is a negative externality associated with firm j's advertising, and combative advertising is a strategic substitute. Following Marshall (1890), cooperative advertising is sometimes called constructive advertising and predatory advertising is sometimes called combative advertising. For further discussion of the theories of advertising, see Bagwell (2007) and Tremblay and Tremblay (2012).

[4]In this case, direct demand functions are relevant, which are obtained by solving the system of equations in (1) for x_1 and x_2: $x_i(p_i, p_j) = \alpha_i - \beta p_i - \gamma p_j$, where $\alpha_i = \frac{a_i}{b+1}, \beta = \frac{b}{b^2-1}$, and $\gamma = \frac{1}{b^2-1}$.

[5]To ensure that each firm's profit function is strictly concave in its own advertising and that the marginal effect of advertising is greater for the firm than its rival, k is assumed to exceed $\mathbf{k} = \left(\frac{3}{2} + \frac{1}{2}\sqrt{5}\right) \max\{k_1, k_4\}$, where $k_1 = \frac{2a^2 b\mu^2}{(2b+1)^2}$ and $k_4 = \frac{2a^2 b(b+1)}{(b-1)(2b+1)^2}$.

[6]This assumption has no qualitative effect on our results. With this assumption, one can interpret the price as the markup of price over marginal cost.

$p_1^* \neq p_2^*, x_1^* \neq x_2^*, \pi_1^* \neq \pi_2^*.$[7] When firms choose these equilibrium price and output levels, firm profits are:

$$\pi_1^* = \frac{B_1(2A_1 + A_2)^2}{(4B_1 + g)^2} - \frac{1}{2}k(m_1 + n_1)^2 \tag{4}$$

$$\pi_2^* = \frac{(2B_1A_2 - gA_1)^2}{g(4B_1 + g)^2} - \frac{1}{2}k(m_2 + n_2)^2 \tag{5}$$

The first major contribution of Ma and Ulph (2012) derives from analysis of the second-stage problem for Cournot and Bertrand. In stage two, each firm maximizes profit in Equations (4) and (5) with respect to advertising, correctly anticipating optimal behavior in the final stage game. The following proposition provides results for all modes of competition: Cournot, Bertrand, and Cournot-Bertrand (Bertrand-Cournot).

Proposition 1. Assume the games described earlier, and let $\varphi_C = \frac{2b+1}{2b-1}$, $\varphi_B = \frac{2b^2+b-1}{2b^2-b-1}$, and $\nu = 1$.[8]

(1) When firms compete in a Cournot game in stage three, it is optimal for both firms to invest in cooperative advertising when $\mu > \varphi_C$ and for both to invest in predatory advertising when $\mu < \varphi_C$.
(2) When firms compete in a Bertrand game in stage three, it is optimal for both firms to invest in cooperative advertising when $\mu > \varphi_B$ and for both to invest in predatory advertising when $\mu < \varphi_B$.
(3) When firms compete in a Cournot-Bertrand game in stage three:
  (a) It is optimal for the Cournot-type firm (firm 1) to invest in cooperative (predatory) advertising when $\mu > \varphi_C$ ($\mu < \varphi_C$).
  (b) It is optimal for the Bertrand-type firm (firm 2) to invest in cooperative (predatory) advertising when $\mu > \varphi_B$ ($\mu < \varphi_B$).

Parts (1) and (2) of the proposition are due to Ma and Ulph (2012, 800–801), their Proposition 1).[9] Part (3) follows from analysis of the Cournot-Bertrand model. Proofs derive from a comparison of the first-order conditions of each firm's profits (Equations 4 and 5) with respect to cooperative and predatory advertising. Because the marginal cost of advertising is the same for both types of advertising, an optimal decision only

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[7]This raises the question—what is the market clearing mechanism in the Cournot-Bertrand model? One possible explanation is as follows. Consider a market where firm 1 sets its Nash level of output and firm 2 sets its Nash price. In this case, consumers play an active role in determining firm 2's output level. This and firm 1's Nash output level determine the market clearing price for firm 1. We wish to thank a referee for raising this issue.

[8]At issue is the relative effectiveness of cooperative advertising (μ) and predatory advertising (ν), and setting ν to 1 is a normalization that simplifies the analysis. Like Ma and Ulph, we ignore the case of indifference where μ equals φ_C or φ_B. In this case, it would be optimal for a firm to invest in either or both types of advertising.

[9]Ma and Ulph also demonstrate that the equilibrium is unique and stable and show that cooperative (predatory) advertising is a strategic complement (substitute).

requires a comparison of the marginal revenues of the two types of advertising. Such a comparison reveals that when the effectiveness of cooperative advertising is sufficiently high (i.e., $\mu > \varphi_C$ for Cournot behavior and $\mu > \varphi_B$ for Bertrand behavior), it is optimal for the firm to invest in cooperative advertising alone.[10] The reverse is true when the effectiveness of cooperative advertising is sufficiently low—it then becomes optimal to invest in predatory advertising.

Part (3) of the proposition provides additional insight into advertising behavior. First, the critical value of μ for the Cournot-type firm in the Cournot-Bertrand model is the same as the critical value in the Cournot model (φ_C); the critical value of μ for the Bertrand-type firm in the Cournot-Bertrand model is the same as the critical value in the Bertrand model (φ_B). Second, because $0 < \varphi_c < \varphi_B$, both firms find it optimal to invest in cooperative (predatory) advertising when $\mu > \varphi_B$ ($\mu < \varphi_C$). More importantly, when $\varphi_c < \mu < \varphi_B$ in the Cournot-Bertrand game, it is optimal for the Cournot-type firm (firm 1) to invest in cooperative advertising and for the Bertrand-type firm (firm 2) to invest in predatory advertising.[11]

Unlike the traditional Cournot and Bertrand models, firms may choose different types of advertising campaigns when Cournot-type firms compete with Bertrand-type firms in the same market. As discussed earlier, there is evidence of this type of asymmetric behavior in the market for small cars: Honda competes in output and uses a mass-market advertising campaign, which is more likely to increase the market demand for small cars; Scion competes in price and uses a niche-market advertising campaign, which tends to be more predatory.

III. Strategic trade policy in advertising

In this section, we investigate whether a country can improve its welfare by imposing a subsidy or tax on the advertising of its home firm. Ma and Ulph (2012) investigate this problem in Cournot and Bertrand settings, using the demand and cost specifications described in the previous section. We assume more general demand and cost conditions and consider Cournot, Bertrand, and Cournot-Bertrand behavior in the product market.

In the first stage of the game, the home government in country i sets τ_i in order to maximize home country welfare. Recall that $\tau_i > 0$ for an advertising

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[10]That is, the marginal revenue of cooperative advertising is greater than the marginal revenue of predatory advertising.

[11]Consider a specific example where $b = 1.5$, $\varphi_c = 2$, and $\varphi_B = 2.5$. If $\mu > 2.5$, both firms invest in cooperative advertising. If $\mu < 2$, both firms invest in predatory advertising. If $2 < \mu < 2.5$, firm 1 invests in cooperative advertising and firm 2 invests in predatory advertising.

subsidy and $\tau_i < 0$ for an advertising tax. The government correctly antici-
pates optimal play in subsequent stage games. The goal is to set τ_i to
maximize country i's welfare[12]:

$$W_i(I_i, I_j) = \Pi_i^h(I_i, I_j, \tau_i) - \tau_i I_i \quad (6)$$

where $\Pi_i^h = \pi_i^h + \tau_i I_i$ is firm i's gross profit, $h \in \{C, B, CB\}$ (where C refers
to Cournot, B to Bertrand, and CB to Cournot-Bertrand), and $I \in \{m, n\}$.[13]

For the specific demand and cost functions described in Section 2, Ma and
Ulph (2012, 802, Proposition 2) establish a second important result. They
show that the optimal strategic industrial policy is an advertising subsidy,
regardless of whether firms invest in cooperative or predatory advertising or
whether firms play a Cournot or a Bertrand game.

It turns out that this proposition can hold for the Cournot-Bertrand model
as well, but only when both firms choose the same type of advertising. If it is
optimal for one firm to invest in cooperative advertising and the other in
predatory advertising, then a tax on the home firm's advertising is optimal.
We formally state and prove this, assuming general demand and cost
conditions.

Our analysis of this duopoly game requires the following assumptions,
which place fewer restrictions on demand, costs and, therefore, profit
functions.[14]

Assumptions:
(A) It pays each firm to participate, and each firm's profit function is twice
continuously differentiable and is strictly concave in its strategic
variables.
(B) A unique equilibrium exists, and Nash equilibrium prices and output
levels are positive.
(C) Cooperative advertising is a strategic complement: $\frac{\partial(\partial\pi_i/\partial m_i)}{\partial m_j} > 0$ and
an increase in m_j will lead to an increase in π_i and the optimal m_i (i.e.,
firm i's best-reply function in advertising has a positive slope).
(D) Predatory advertising is a strategic substitute: $\frac{\partial(\partial\pi_i/\partial n_i)}{\partial n_j} < 0$ and an
increase in n_j will lead to an decrease in π_i and the optimal n_i (i.e., firm
i's best-reply function in advertising has a negative slope).
(E) If firm i invests in cooperative advertising and firm j in predatory
advertising, firm i's advertising is a strategic substitute with firm j's
advertising: $\frac{\partial(\partial\pi_i/\partial m_i)}{\partial n_j} < 0$ and an increase in n_j will lead to an decrease

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[12]This specification assumes that there are no tax distortions. Collie (2002) allows for a tax distortion by adding
parameter $\lambda \geq 1$ to the welfare function. In his specification, $W_i(I_i, I_j) = \Pi_i^h(I_i, I_j, \tau_i) - \lambda\tau_i I_i$. When $\lambda = 1$,
there is no tax distortion. When $\lambda > 1$, there is an added deadweight loss due to tax distortions.

[13]In essence, $W_i = \pi_i^h$. Because π_i^h only is indirectly affected by τ_i, W_i only is directly affected by I_i and I_j.

[14]This identifies duopoly games with the "typical" geometries or mathematical structures (Okuguchi 1987; Amir and
Grilo 1999). Tremblay et al. (2013) discuss the strategic complementarity and substitutability between q and p in
Cournot-Bertrand games.

in π_i and the optimal m_i (i.e., firm i's best-reply function in advertising has a negative slope).

(F) If firm i invests in predatory advertising and firm j in cooperative advertising, firm i's advertising is a strategic complement with firm j's advertising: $\frac{\partial(\partial \pi_i / \partial n_i)}{\partial m_j} > 0$ and an increase in m_j will lead to an increase in π_i and the optimal n_i (i.e., firm i's best-reply function in advertising has a positive slope).

Proposition 2: Under these conditions:

(1) If it is optimal for both firms to invest in the same type of advertising (cooperative or predatory), then the optimal strategic industrial policy is an advertising subsidy irrespective of the form of product market competition (Cournot, Bertrand, or Cournot-Bertrand).

(2) When it is optimal for one firm to invest in cooperative adverting and the other firm to invest in predatory advertising in the Cournot-Bertrand model, then the optimal strategic industrial policy is an advertising tax.

Proof:

(1) The total differential of country i's welfare function is:

$$dW_i = \left(\frac{\partial \Pi_i^h}{\partial I_i} - \tau_i \frac{\partial I_i}{\partial I_i} \right) dI_i + \frac{\partial \Pi_i^h}{\partial I_j} dI_j \tag{7}$$

Profit maximization implies that $\frac{\partial \Pi_i^h}{\partial I_i} = 0$. Setting dW_i to zero and solving for τ_i gives the optimal subsidy/tax:

$$\tau_i^* = \frac{\partial \Pi_i^h}{\partial I_j} \frac{dI_j}{dI_i} \tag{8}$$

The first term on the right-hand side of Equation (8) indicates the effect of rival advertising on firm i's profit ($\partial \Pi_i^h / \partial I_j$). When firm j's advertising is cooperative ($I_j = m_j$), $\partial \Pi_i^h / \partial I_j > 0$. When it is predatory ($I_j = n_j$), $\partial \Pi_i^h / \partial I_j < 0$. The second term is the slope of firm j's best reply function, which is positive (negative) when firm i's advertising is a strategic complement (substitute) with firm j's advertising. The following identifies whether τ_i^* is a subsidy ($\tau_i^* > 0$) or a tax ($\tau_i^* < 0$) for each mode of competition and type of advertising.

(a) In a Cournot game (h = C) with cooperative advertising ($I_i = m_i$ and $I_j = m_j$), $\partial \Pi_i^h / \partial I_j > 0$, $dI_j / dI_i > 0$, and $\tau_i^* > 0$.

(b) In a Cournot game (h = C) with predatory advertising ($I_i = n_i$ and $I_j = n_j$), $\partial \Pi_i^h / \partial I_j < 0$, $dI_j / dI_i < 0$, and $\tau_i^* > 0$.

(c) In a Bertrand game (h = B) with cooperative advertising ($I_i = m_i$ and $I_j = m_j$), $\partial\Pi_i^h/\partial I_j > 0$, $dI_j/dI_i > 0$, and $\tau_i^* > 0$.

(d) In a Bertrand game (h = C) with predatory advertising ($I_i = n_i$ and $I_j = n_j$), $\partial\Pi_i^h/\partial I_j < 0$, $dI_j/dI_i < 0$, and $\tau_i^* > 0$.

(e) In a Cournot-Bertrand game (h = CB) with cooperative advertising ($I_i = m_i$ and $I_j = m_j$), $\partial\Pi_i^h/\partial I_j > 0$, $dI_j/dI_i > 0$, and $\tau_i^* > 0$.

(f) In a Cournot-Bertrand game (h = CB) with predatory advertising ($I_i = n_i$ and $I_j = n_j$), $\partial\Pi_i^h/\partial I_j < 0$, $dI_j/dI_i < 0$, and $\tau_i^* > 0$.

(g) In a Cournot-Bertrand game (h = CB) where firm i invests in cooperative advertising ($I_i = m_i$) and firm j invests in predatory advertising ($I_j = n_j$), $\partial\Pi_i^h/\partial I_j < 0$, $dI_j/dI_i > 0$, and $\tau_i^* < 0$.

(h) In a Cournot-Bertrand game (h = CB) where firm i invests in predatory advertising ($I_i = n_i$) and firm j invests in cooperative advertising ($I_j = m_j$), $\partial\Pi_i^h/\partial I_j > 0$, $dI_j/dI_i < 0$, and $\tau_i^* < 0$. □

Part (1) of Proposition 2 extends Ma-Ulph's work by allowing for more general profit functions and by considering Cournot-Bertrand behavior when both firms invest in the same type of advertising. In this case, an advertising subsidy is always welfare-improving. However, part (2) of our analysis demonstrates that when firms compete in a Cournot-Bertrand game where it is optimal for one firm to invest in cooperative advertising and the other firm to invest in predatory advertising, then an advertising tax is optimal.

The intuition behind Proposition 2 is straightforward. Recall that there is a positive externality associated with cooperative advertising and a negative externality associated with predatory advertising. Thus, country i's optimal trade policy in advertising is to encourage firm j's cooperative advertising and discourage firm j's predatory advertising. When firms i and j both invest in cooperative advertising, country i should subsidize firm i's advertising because this increases m_i, which will increase m_j and π_i. When firms i and j both invest in predatory advertising, country i should subsidize firm i's advertising because this increases n_i, which will decrease n_j and increase π_i. If one firm invests in cooperative advertising and the other firm invests in predatory advertising, which is possible in the Cournot-Bertrand model, then it pays country i to tax firm i's advertising. When firm i invests in cooperative advertising and firm j in predatory advertising, a tax will reduce m_i, which will reduce n_j and increase π_i. When firm i invests in predatory advertising and firm j in cooperative advertising, a tax will reduce n_i, which will increase m_j and increase π_i.

This parallels the result on strategic trade policy in the product market, which demonstrates that, in some cases, a tax is optimal, but in others a subsidy is optimal. Ma and Ulph's (2012) model suggests that it is optimal for a home country to subsidize advertising in a third-country model, whether firms behave as Cournot or Bertrand competitors. Our work contributes to

this literature by showing that an advertising subsidy is not always optimal for the home country. To improve welfare, the home country must identify policies that will encourage foreign firms to spend more on cooperative advertising and less on predatory advertising. In some cases, this requires a subsidy, but in others it requires a tax on the home firm's advertising.

IV. Conclusion and policy implications

Export subsidies by developed countries are generally banned by the WTO, but there are exceptions under which advertising is subsidized. As observed by Ma and Ulph, the 2004 American Jobs Creation Act subsidized advertising for U.S. firms via a tax holiday, the extra funds from which could be used for advertising. Importantly, the WTO does allow export subsidies on agricultural goods. The U.S. Department of Agriculture's Market Access Program (MAP) provides funding for overseas marketing activities such as advertising. Choosing the optimal policy for agricultural exports is important, as international markets for food and other agricultural products are often imperfectly competitive, with both Cournot- and Bertrand-type competition observed (Reimer and Stiegert 2006).

The debate over reducing export subsidies allowed by the WTO is ongoing, most recently during negotiation of the Bali Package in December 2013. Much like in the case of policies toward exports themselves, subsidies for advertising of exports are observed, but taxes on advertising are not typically found. As mentioned earlier, however, Cournot-Bertrand markets have been observed in the real world, which means that, in some cases, it will be optimal for governments to tax advertising on exports. It is therefore important to consider taxes as well as subsidies on advertising during the ongoing reforms of international trade policy.

One caveat is that our model only considers the third-country model and ignores such models as the reciprocal-markets model. Regardless of the market setting, however, it is likely that the policy prescription will be the same: the home country will want to implement a policy that encourages the cooperative advertising and discourages the predatory advertising of foreign firms. Whether this involves an advertising subsidy or tax in Cournot, Bertrand, and Cournot-Bertrand models is a topic for future research.

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References

Amir, R., and I. Grilo. 1999. "Stackelberg versus Cournot Equilibrium." *Games and Economic Behavior* 26:1–21. doi:10.1006/game.1998.0650.

Bagwell, K. 2007. "The Economic Analysis of Advertising." In *Handbook of Industrial Organization*, edited by M. Armstrong and R. H. Porter, vol. 3, 1701–844. Amsterdam: North-Holland.

Bowley, A. L. 1924. *Mathematical Groundwork of Economics: An Introductory Treatise*. Oxford: Oxford University Press.

Brander, J. A., and B. J. Spencer. 1985. "Export Subsidies and International Market Share Rivalry." *Journal of International Economics* 18:83–100. doi:10.1016/0022-1996(85)90006-6.

Collie, D. R. 2002. "Prohibiting State Aid in an Integrated Market: Cournot and Bertrand Oligopolies with Differentiated Products." *Journal of Industry, Competition, and Trade* 2 (3):215–31. doi:10.1023/A:1021532508081.

Dixit, A. 1979. "A Model of Duopoly Suggesting a Theory of Entry." *Bell Journal of Economics* 10 (1):20–32. doi:10.2307/3003317.

Eaton, J., and G. M. Grossman. 1985. "Optimal Trade and Industrial Policy under Oligopoly." *Quarterly Journal of Economics* 101:383–406.

Ma, J., and A. M. Ulph. 2012. "Advertising Subsidy and International Oligopolistic Competition." *Review of International Economics* 20 (4):793–806. doi:10.1111/roie.2012.20.issue-4.

Maggi, G. 1996. "Strategic Trade Policies with Endogenous Mode of Competition." *American Economic Review* 86 (1):237–58.

Marshall, A. 1890. *Principles of Economics*. London: Macmillan Publishing.

Martin, S. 2002. *Advanced Industrial Organization*. Malden, MA: Blackwell Publishers.

Okuguchi, K. 1987. "Equilibrium Prices in the Bertrand and Cournot Oligopolies." *Journal of Economic Theory* 42 (1):128–39. doi:10.1016/0022-0531(87)90106-2.

Reimer, J. J., and K. Stiegert. 2006. "Imperfect Competition and Strategic Trade Theory: Evidence for International Food Agricultural Markets." *Journal of Agricultural & Food Industrial Organization* 4:6. doi:10.2202/1542-0485.1134.

Schroeder, E., and V. J. Tremblay. Forthcoming. "A Reappraisal of Strategic Trade Policy." *Journal of Industry, Competition and Trade*. doi:10.1007/s10842-015-0195-7.

Singh, N., and X. Vives. 1984. "Price and Quantity Competition in a Differentiated Duopoly." *Rand Journal of Economics* 15 (4):546–54. doi:10.2307/2555525.

Tremblay, C. H., and V. J. Tremblay. 2011. "The Cournot-Bertrand Model and the Degree of Product Differentiation." *Economics Letters* 111 (3):233–35. doi:10.1016/j.econlet.2011.02.011.

Tremblay, V. J., and C. H. Tremblay. 2012. *New Perspectives on Industrial Organization: With Contributions from Behavioral Economics and Game Theory*. New York: Springer.

Tremblay, V. J., C. H. Tremblay, and K. Isariyawongse. 2013a. "Endogenous Timing and Strategic Choice: The Cournot-Bertrand Model." *Bulletin of Economic Research* 65 (4):332–42. doi:10.1111/boer.2013.65.issue-4.

Tremblay, V. J., C. H. Tremblay, and K. Isariyawongse. 2013b. "Cournot and Bertrand Competition when Advertising Rotates Demand: The Case of Honda and Scion." *International Journal of the Economics of Business* 20 (1):125–41. doi:10.1080/13571516.2012.750045.