Consumers' Misevaluation and Public Promotion*

Atsushi Yamagishi †
Graduate School of Economics, The University of Tokyo

September 19, 2016

Abstract

I analyze markets in which consumers may misestimate the true value of goods and the government can affect the valuation through public promotion. When entry of firms is not allowed, the government makes consumers overvalue the goods to mitigate welfare loss from underproduction in an oligopolistic market, provided that the promotion cost is sufficiently low. On the contrary, in a free-entry market, no matter how low the promotion cost is, the government may make consumers undervalue them in order not to induce wasteful entries despite the remaining underproduction problem. In addition, my result in a free-entry market suggests that the main finding of Glaeser and Ujhelyi (J Public Econ 94: 247-257, 2010) crucially depends on the barriers to entry and the opposite result may be obtained under free entry.

JEL classification: L13, L38, M37

Keywords: consumers' misevaluation, public promotion, excess entry

*I would like to thank Toshihiro Matsumura and all seminar participants at The University of Tokyo. I am also indebted to an anonymous referee and the editor-in-chief, Sandra Ludwig, for their helpful comments and suggestions. Needless to say, I am responsible for any remaining errors.

†Correspondence to: 7-3-1 Hongo, Bunkyo-ku, Tokyo, Japan. E-mail: atsushiyamagishi.econ@gmail.com

1 Introduction

Consumers often misestimate the value of goods and the government tries to affect their valuation by engaging in public promotion. To illustrate that such a situation is common, I provide two examples.

The first example is a new kind of products based on an innovative technology. Since consumers are not generally familiar with a new product they have not seen, they may make a mistake in evaluating its usefulness. They may exhibit psychological resistance to its introduction (Ram and Sheth, 1989), which leads to the undervaluation. On the other hand, when consumers do not know drawbacks of the product, they may overvalue it. In such a case, the government often provides information to consumers so that they can know its real value.

The second example is about evaluating risks. Literatures on behavioral economics (e.g., Tversky and Kahneman, 1974) have shown that people tend to make various mistakes in evaluating risks. For instance, people may overestimate the probability of airplane accidents compared to that of car accidents so that they underestimate the value of travels by plane. People may be tempted to smoke, which prevents them from evaluating the risk of smoking correctly. Overconsumption of tobacco is likely to occur in this case. To cope with these evaluation errors, the government can use public promotion.[1]

Motivated by these observations, I consider a market with misestimating consumers and analyze the role of public promotion. I find that when the entry of firms is prohibited, the government tries to make consumers overvalue the goods to mitigate underproduction in an oligopolistic market, provided that the advertisement cost is sufficiently small. On the contrary, in a free-entry market with an entry cost, the result is completely different. Even though the underproduction problem still remains, the government may make consumers underestimate the true value in order not to induce excessive entries irrespective of the size of the promotion cost. This result suggests that the optimal level of public promotion crucially depends on the barriers to entry.

[1]For example, many governments emphasize the risk of smoking. See `http://www.who.int/mediacentre/factsheets/fs339/en/`.

Many recent studies consider misleading advertisement in a market and the reactions of the public sector toward it (e.g., Glaeser and Ujhelyi, 2010; Matsumura and Sunada, 2013; Hattori and Higashida, 2012, 2015). They have assumed that advertisement misleadingly increases consumers' valuation of goods and consumers know their true value if there is no advertement. While I do not consider misleading advertisement by private firms in the prsent paper, I extend this framework in that free entry of firms are allowed, consumers may initially misestimate the value of goods, and the government can use public promotion to expand or shrink the demand.[2]

The model used in this paper inherits the basic structure from Glaeser and Ujhelyi (2010) and so my result is comparable to that of Glaeser and Ujhelyi (2010). Glaeser and Ujhelyi (2010) show that making consumers overvalue goods is socially optimal because it is useful in alleviating welfare loss due to underproduction in an oligopolistic market. However, my result shows that the opposite result may hold under free entry. To maximize social welfare, the govenment may choose to make consumers undervalue the goods in a free-entry market. In other words, the result of Glaeser and Ujhelyi (2010) is not robust against the introduction of free entry.

2 The model

There are two markets: a no-entry market and a free-entry market. These two markets are modeled in the same way except for the assumption on firms' entry. Hence, I propose these two models simultaneously. In the first stage, the government provides public promotion, which affects consumers valuation of the goods. The level of promotion is denoted by $z \in (\underline{z}, \overline{z})$ with $-\infty < \underline{z} < 0$ and $0 < \overline{z} < \infty$. Positive z corresponds to the positive campaign which increases the demand, and vice versa. The government is assumed to maximize social welfare. The promotion cost is given by $C(z)$. I assume that $C(z) : (\underline{z}, \overline{z}) \mapsto \mathcal{R}_+$ is twice differentiable, $C'(0) = 0$, $C'(z) < 0$ for all $z \in (\underline{z}, 0)$, $C'(z) > 0$ for all $z \in (0, \overline{z})$,

[2]The role of public promotion which affects demand is also analyzed in Glaeser and Ujhelyi (2010) as a countermeasure against private misleading advertising and Hattori and Higashida (2011) as a trade policy.

and $C''(z) \geq 0$. I further assume that $\lim_{z \to \underline{z}} C'(z) \to -\infty$ and $\lim_{z \to \overline{z}} C'(z) \to \infty$. In the second stage, firms enter the market. In a market with free entry, a potentially infinite number of identical private firms enter the market if and only if they earn a positive profit and exit if they earn a negative profit. On the contrary, in a no-entry market, an exogenous number of identical firms enter the market.[3] Let $n \geq 2$ denote the number of firms in a market. In the third stage, n private firms in the market compete on quantity. Firm i $(i = 1, 2, ..., n)$ chooses its output level q_i to maximize its profit π_i. I assume firm i's marginal cost is 0. Let $Q = \sum_{i=1}^{n} q_i$. The demand function is given by $P = a + z - bQ$, where P is the price of the homogeneous product and $a, b > 0$ are the parameters.[4] Note that public promotion z shifts the demand function vertically; that is, the government can use public promotion to increase or decrease demand in a market.

I assume consumers may misestimate the value of goods; therefore, when consumers know the true value, the demand function becomes $P = a + g - bQ$ where $g \in (\underline{z}, \overline{z})$. Here, g represents the gap between consumers' initial valuation and the true value they bring when consumed. When $z < g$, consumers are undervaluing the goods. In this case, consumers are not fully aware of the usefulness of the goods. Similarly, consumers are overvaluing them when $z > g$ and correctly valuing them when $z = g$. When $z > g$, consumers are misleaded as in Glaeser and Ujhelyi (2010).

In this economy, total social surplus W is

$$W = \int_0^Q (a + g - bY)dY - PQ + \sum_{i=0}^{n} \pi_i - C(z) = (a + g)Q - \frac{b}{2}Q^2 - nF - C(z), \quad (1)$$

where $F > 0$ is the fixed entry cost for firms. Consumer surplus is evaluated by using the "true" demand function $P = a + g - bQ$ to capture the actual benefit they receive.

3 Equilibrium

I solve the two games by backward induction.

[3]Note that since n is exogenous and commonly known, whether firms enter before or after the government's advertisement does not affect the government's decision. I employ this entry timing to simplify the exposition of the model.

[4]I impose $a + \underline{z} > 0$ to exclude the case in which consumers do not demand anything.

3.1 No-entry market

In the third stage, firms engage in standard Cournot competition. Firm $i(i = 1, 2, ..., n)$ chooses q_i to maximize $\pi_i = (a + z - bQ)q_i - F$. I focus on the symmetric equilibrium. Let q^* denote the equilibrium output of each private firm and $Q^* = nq^*$. I have

$$q^* = \frac{a+z}{(n+1)b}, \ Q^* = \frac{n(a+z)}{(n+1)b}. \tag{2}$$

In the second stage, a fixed number n of firms enter the market. In the first stage, the government chooses the promotion level z to maximize total surplus (1). The first-order condition is given by

$$bC'(z) + \frac{n^2}{(n+1)^2}z = \frac{an}{(n+1)^2} + \frac{gn}{n+1}. \tag{3}$$

The second-order condition is satisfied. Let the solution of (3) be z^*. z^* always exists and is determined uniquely.[5]

3.2 Free-entry market

Next, we consider a market with free entry. The third stage is exactly the same as that in subsection 3.1 and the equilibrium output of each firm is given by (2). In the second stage, a firm enters the market if and only if it earns positive profit and exits if and only if it earns negative profit. Therefore, the equilibrium number of entering firms is characterized by the zero profit condition

$$\pi_i = (a + z - bQ^*) - F = 0. \tag{4}$$

The equilibrium number of firms n^* is attained by solving (4):[6]

$$n^* = \frac{a+z}{\sqrt{Fb}} - 1. \tag{5}$$

[5]To see this, note first that the LHS of (3) is strictly increasing in z because $C''(z) \geq 0$ for all $z \in (\underline{z}, \overline{z})$ and $n^2/(n+1)^2 > 0$. Then, since in (3) LHS $\to -\infty$ as $z \to \underline{z}$ and LHS $\to \infty$ as $z \to \overline{z}$, z^* is always uniquely determined.

[6]In this paper, I do not consider the integer problem.

I assume that, in all relevant cases, the entry cost F is sufficiently small so that $n^* \geq 2$.

In the first stage, the government chooses z to maximize total welfare W. By substituting (2) and (5) into (1) and differentiating it w.r.t. z, I get the first-order condition:

$$z + bC'(z) = g. \tag{6}$$

The second-order condition is satisfied. Denote the solution of (6) by z^{**}. z^{**} always exists and is determined uniquely.[7] Further, note that a and F do not affect the solution.

4 Results

I consider the equilibrium outcome of the two games. From (3), I find the following proposition regarding a no-entry market.

Proposition 1 *(i)* $\partial z^*/\partial a > 0$ *and* $\partial z^*/\partial g > 0$. *Moreover,* $\partial z^*/\partial b < (>, =)0$ *if* $z^* > (<, =)0$.
(ii) $z^* > (<, =)g$ *if* $C'(g) < (>, =)\dfrac{(a+g)n}{b(n+1)^2}$. *Thus, the government makes consumers overvalue the goods if* $C'(g)$ *is sufficiently small.*

Proof See the Appendix.

Proposition 1(i) is about the comparative statistics of z^*. $\partial z^*/\partial g > 0$ is intuitive. $\partial z^*/\partial a > 0$ because a higher intercept of the demand function implies the larger effect of promotion on consumer surplus. The sign of $\partial z^*/\partial b$ means that z^* tends to become closer to 0 as b increases. The increase in b implies that the change in the public promotion z has smaller impact. Thus, the government shrinks the absolute size of the public promotion.

Proposition 1(ii) states that, given that the marginal cost of the public promotion is low at $z = g$, the government chooses to make comsumers overvalue the goods in equilibrium. The intuition behind this result is that, since the government can use public promotion to change demand, by making the demand high it can offset underproduction

[7] This result can be shown by the same reasoning I used to establish the existence and uniqueness of z^*.

in an oligopoly. This logic also appears in Glaeser and Ujhelyi (2010), although they do not consider consumers' initial misestimation.

On the other hand, when the marginal cost of public promotion is too high, the government does not make consumers overvalue the goods since it is too costly.

Now, I move onto the analysis of a free-entry market. I find the following proposition about the level of public promotion in a free-entry market.

Proposition 2 *$z^{**} < (>, =) g$ if $g > (<, =) 0$. That is, the government makes consumers undervalue (overvalue, correctly evaluate) the goods if they initially undervalue (overvalue, correctly evaluate) the goods.*

Proof See the Appendix.

Proposition 2 is in stark contrast to Proposition 1(ii). Proposition 1(ii) states that the government tries to make consumers overestimate the value of goods when $C'(g)$ is sufficiently small. On the contrary, Proposition 2 states that whether the government tries to make consumers overvalue or undervalue the goods depends on the sign of the initial misestimation.

If $g > 0$ so that consumers initially undervalue the goods, the government chooses to keep consumers undervaluing the goods no matter how low the promotion cost is. This result is remarkable because the driving force of Proposition 1(ii), the underproduction problem in an oligopolistic market, still remains. Intuitively, in a no-entry market, the government must take into account the effect of public promotion on firms' decisions about entry. If the government makes the demand high through public promotion, the increase in the sales of goods induces more entries, which require entry costs. As Mankiw and Whinston (1986) and Suzumura and Kiyono (1987) show, when $z = g$, meaning that the demand function coincides with the "true" demand function, there is welfare loss due to the excessive entry of firms (the excess entry theorem). Therefore, the government has an incentive to decrease the level of public promotion compared with that in a no-entry market. Since the underproduction problem remains, the government also has an incentive

to increase the promotion level z. However, as long as $g > 0$, the former incentive is always large enough to make the government try to make consumers undervalue the goods.

On the other hand, when $g < 0$ so that consumers initially overvalue the goods, the government chooses to keep consumers overvalue them. Under free entry, the government does not try to change the sign of misestimation.

In addition, Proposition 2 shows that the main result of Glaeser and Ujhelyi (2010) depends on the assumption of no entry. In a no-entry market with no misestimation ($g = 0$), Glaeser and Ujhelyi (2010) find that at the welfare-maximizing point consumers overestimate the value of goods since it mitigates the underproduction problem. In a free-entry market, however, consumers may not overvalue the goods at the welfare-maximizing point. If $g \geq 0$ so that consumers initially do not overvalue the goods, consumers do not overvalue them at the welfare-maximizing point.

5 Concluding Remarks

I consider a market in which consumers may initially misestimate the value of goods and the government can engage in public promotion to affect the market demand. I find that in a no-entry market, the government makes consumers overvalue the goods to alleviate welfare loss due to underproduction in an oligopoly when the promotion cost is sufficiently low. On the contrary, if firms can enter a market freely, the government may not try to make consumers overvalue the goods in spite of the remaining welfare loss due to underproduction as long as they do not overvalue them initially. Moreover, this result holds no matter how low the promotion cost is. This result suggests that the level of the public promotion by the welfare-maximizing government crucially depends on the barriers to entry in a market, providing a benchmark for evaluating the public sector's actions toward markets for goods that consumers may not initially evaluate correctly. In addition, this result also suggests that the main result of Glaeser and Ujhelyi (2010) may reverse in a free-entry market.

In this paper, I assumed that simple Cournot competition takes place between firms. However, other kinds of competition such as Bertrand and Stackelberg competition are

conceivable. Moreover, unlike previous studies of misleading advertisement (e.g., Glaeser and Ujhelyi, 2010; Matsumura and Sunada, 2013; Hattori and Higashida, 2012, 2015), I do not consider the possibility that private firms can advertise and engage in advertising competition. Allowing for these possibilities is left for future research.

A Appendix

Proof of Proposition 1

By applying the implicit function theorem to (3), I have

$$\frac{\partial z^*}{\partial a} = \frac{\dfrac{n}{(n+1)^2}}{bC''(z^*) + \dfrac{n^2}{(n+1)^2}} > 0,$$

$$\frac{\partial z^*}{\partial b} = \frac{-C'(z^*)}{bC''(z^*) + \dfrac{n^2}{(n+1)^2}} \gtreqless 0,$$

$$\frac{\partial z^*}{\partial g} = \frac{\dfrac{n}{n+1}}{bC''(z^*) + \dfrac{n^2}{(n+1)^2}} > 0.$$

where $\partial z^*/\partial b < (>, =)0$ if $z^* > (< . =)0$.

Now I prove Proposition 1(ii). When $C'(g) < (>, =)\dfrac{(a+g)n}{b(n+1)^2}$, LHS $< (>, =)$ RHS in (3) at $z = g$. Remember that z^* always exists and is unique. $z^* > (<, 0)g$ follows because, in (3), LHS $< (>, =)$ RHS at $z = g$, the LHS is strictly increasing in z, and the RHS is independent of z. Q.E.D.

Proof of Proposition 2

Note that z^{**} is always well defined and determined uniquely. When $g > (<, =)0$, $C'(g) > (<, =)0$. Since LHS $> (<, =)$ RHS at $z = g$ in (6), the LHS of (6) is strictly increasing, and the RHS of (6) does not depend on z, $z^{**} < (>, =)g$ holds. Q.E.D.

References

[1] Glaeser, E.L., Ujhelyi, G. 2010. Regulating misinformation. Journal of Public Economics 94, 247-257.

[2] Hattori, K., Higashida, K. 2011. When government misleads US: sending misinformation as protectionist devices. Kwansai Gakuin University Discussion Paper Series 75.

[3] Hattori, K., Higashida, K. 2012. Misleading advertising in duopoly. Canadian Journal of Economics 45, 1154-1187.

[4] Hattori, K., Higashida, K. 2015. Who benefits from misleading advertising? Economica 82, 613-643.

[5] Mankiw, N.G., Whinston, M. D. 1986. Free entry and social inefficiency. RAND Journal of Economics 17, 48-58.

[6] Matsumura, T., Sunada, T. 2013. Advertising competition in a mixed oligopoly. Economics Letters 119, 183-185.

[7] Ram, S., Sheth, J, N. 1989. Consumer resistance to innovations: the marketing problem and its solutions. Journal of Consumer Marketing 6(2), 5-14.

[8] Suzumura, K., Kiyono, K. 1987. Entry barriers and economic welfare. Review of Economic Studies 54, 157-167.

[9] Tversky, A., Kahneman, D. 1974. Judgement under uncertainty: heuristics and biases. Science 185, 1124-1131.