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Monopolistic Competition and Public Good Provision with By-product Firms*

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Abstract

I develop a model in which the voluntary contributions mechanism for the provision of public goods totally breaks down in a large society. A by-product firm sells a private good and uses its profits to provide a public good. By-product firms compete with for-profit firms in a monopolistically competitive industry. If the number of by-product firms is proportional to the size of the society, then public good provision rises without bound as the society grows large. This stands in strong contrast to the results under the voluntary contributions mechanism.

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1. Introduction

A by-product firm sells a private good and uses the profits to provide a public good. In this paper, I examine by-product firms in a model where private goods are produced in a monopolistically competitive market. In this environment, the voluntary contributions mechanism for the provision of public goods totally fails in a large group. By contrast, when there are by-product firms whose number increases in proportion to the size of the society, public good provision rises without bound in group size. This shows that by-product firms can achieve a significant degree of success in providing a public good in an environment where the voluntary contributions mechanism fails totally.

One category of by-product firms is industry associations which sell private goods to members and engage in lobbying activity with the profits. This is discussed in Olson (1965) as a mechanism by which an interest group can overcome the free-rider problem inherent in lobbying.[1] The AARP is an example of such an organization. This group sells memberships which provide a magazine and group discounts, while using profits from these memberships to lobby the government on issues such as Medicare and Social Security. Similarly, the National Rifle Association provides a variety of services to its members, and uses the resulting profits to lobbying the government on issues related to firearms. A second category of by-product firms includes nonprofits organizations that sell private goods and use the resulting profits to provide a public good. For example, groups such as the World Wildlife Fund and the Audubon Society sell calendars and other items and use the profits to help support their activities which provide environmental amenities.[2]

[1] Also see the discussion of this issue in Moore (1961).The lobbying activity will constitute a public good to the members of the interest group, but will not necessarily be a public good to the society at large.

[2] It is quite common for groups such as schools and the Girl Scouts to fund raise by selling private goods (candy, cookies, etc.), even though very close substitutes for these private goods are offered by for-profit firms. To the

The by-product firms in my model turn over all their profits towards provision of the public good, and in this sense are "nonprofit entities". Thus, the model does not cover related activities by for-profits firms. These firms sometimes link the sale of private goods to the provision of public goods. For example, Target gives 5% of its pretax profits to charitable activities.[3] While the model does not encompass the activities of for-profit firms, the framework it provides should provide an important basis for future work addressing this issue.[4]

2. Background

2.1 Public Goods and Monopolistic Competition

Pecorino (2009) has previously analyzed the voluntary contributions mechanism in a model in which private goods are produced in a monopolistically competitive market. (This work does not analyze by-product firms.) In such an economy, the marginal utility of income may increase with the size of the society. As the society gets larger, the number of private goods available for consumption endogenously increases, and this is what may lead to an increase in the marginal utility of income. When the marginal utility of income increases, the opportunity cost of contributing to the public good increases and the equilibrium level of contributions falls. Thus, in Pecorino (2009), public good provision is monotonically decreasing in the size of the society and falls towards 0 in a large group. In this paper, I consider a generalization of the preferences considered in Pecorino (2009), but I find that the large group results continue to hold. For a sufficiently large group, provision of the public good will decrease in the group size and will fall

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extent that these groups are able to sell these private goods at a premium, this is consistent with the mechanism which drives the success of by-product firms in this paper.

[3] See the corporate site at http://pressroom.target.com/pr/news/community-giving.aspx.

[4] There are also organizational hybrids such as (RED), which is a nonprofit that partners with for-profit firms. Some of the goods sold by these for-profit firms are specially labeled indicating that 50% of the profit from the sale of the good will be donated to the Global Fund in order to fight AIDS.

to zero as group size grows without bound. This is true for all admissible parameter values for the utility function utilized in this paper. Thus, the model provides a backdrop in which the voluntary contributions mechanism totally fails in a large group. By contrast, in this same setting, by-product firms will succeed in providing public goods, even as group size grows large.

2.2 By-product firms

As noted earlier, the concept of a by-product firm dates to Olson (1965). Posnett and Sandler (1986) consider a by-product firm in a perfectly competitive market. In this setting, the by-product firm can only replicate the level of contributions achieved under the voluntary contributions mechanism. When the market for the private good is monopolistically competitive, Pecorino (2001, 2010) has shown that the by-product firm can provide a higher level of the public good than can be achieved by the voluntary contributions mechanism. Pecorino (2001) analyzes a single by-product firm in partial equilibrium. Pecorino (2010) analyzes by-product firms in general equilibrium, and allows the number of these firms to grow in proportion to the size of the society. In that paper, the public good is an intermediate input into production. When the public good is an intermediate input into production, an increase in the marginal utility of income raises the opportunity cost of contributing to the public good, but also raises the benefit of contributing in the same proportion. As a result, in Pecorino (2010), provision of the public good is unaffected by changes in the marginal utility of income. The main question addressed by this work is whether by-product firms can succeed in providing public goods which exhibit a degree of rivalry. They can, even as group size grows large, if the degree of rivalry is sufficiently small.

In the current paper, the public good is a consumption good and, other things equal, an increase in the marginal utility of income will lower the provision of the public good, whether this is achieved by the voluntary contributions mechanism or a by-product firm. Moreover, in this model the marginal utility of income rises without bound as group size becomes large. Despite this, by-product firms can succeed in a large group, provided the number of these firms increases in proportion with the size of the society. In particular, public good provision rises without bound as the size of the society grows large.

In the Posnett and Sandler and Pecorino papers, the by-product firm has no inherent advantage over individuals in making contributions to the public good. Kotchen (2006) analyzes the provision of green goods by perfectly competitive firms, while allowing these firms a technological advantage to the joint provision of the public and private good.[5] Kotchen finds ambiguous welfare effects from the presence of by-product firms, relative to the situation where only direct contributions are made. Another approach is found Bagnoli and Watts (2003) who assume that consumers receive a warm glow benefit when they buy a private good from a by-product firm. While they find that public goods are frequently underprovided, they may, under some circumstances, be overprovided. [6]

Several empirical studies have recently emerged which support the basic plausibility of the by-product model. For the model to be empirically relevant, consumers must be willing to pay a premium for private goods whose purchase is linked to the provision of a public good. Teisl et al. (2002) find that a dolphin safe label increases demand for tuna. Casadesus-Masanell et al. (2009) find an increased willingness to pay for organic cotton. The authors argue that organic cotton does not provide a direct consumption benefit, but that it does provide a public good in the form of environmental benefits. Elfenbein and McManus (2010) find, for otherwise

[5] Similarly, Besley and Ghatak (2007) develop a model of corporate social responsibility where, due to transactions costs, firms may have a technological advantage providing public goods. For more on corporate social responsibility, see Barron (2001).

[6] For more on the analysis of by-product firms, see Mayer (2002). Also related are the joint products model and models of warm glow giving. See Cornes and Sandler (1984) and Andreoni (1989, 1990).

identical objects auctioned on eBay, that prices are 6% higher for charity auctions. [7] Landry and Price (2007) find that lottery expenditures are higher when the net proceeds are earmarked for education. [8] In a field experiment, Hiscox and Smyth (2011) report that consumers are willing to pay a premium for goods labeled as having been produced with fair labor standards. Galarraga and Markandya (2004) report that consumers are willing to pay an 11% premium for coffee produced in an environmentally friendly way. This group of studies is consistent with the idea that consumers will voluntarily pay a premium for private goods which are linked to the provision of a public good.

2.3. Preferences over Private Goods

In this paper, private goods are produced in a monopolistically competitive market. This part of the model is based on the work of Krugman (1980, 1981).[9] In Krugman (1980), preferences take the form: $U_j = \sum_{i=1}^{n} C_{ij}^{\theta}$, where $0 < \theta < 1$, C_{ij} denotes consumption of good i, by person j, and n is the number of endogenously determined varieties. Pecorino (2009) adds a separable function to reflect utility from a public good to the utility function from Krugman. He finds that public good provision decreases in the size of the society.[10] As the society increases, the number of varieties n also increase, and this leads to an increase in the marginal utility of income. Mondal (2010) uses preferences for private goods from Krugman (1981), which take the form $U_j = \ln\left(\sum_{i=1}^{n} C_{ij}^{\theta}\right)^{(1/\theta)}$. This allows for diminishing marginal utility for private goods as a

[7] For a theoretical treatment of charity auctions, see Engers and McManus (2007).

[8] The analysis of the by-product firm bears a relationship to the Morgan (2000) lottery mechanism. Under Morgan's mechanism, an individual buys a lottery ticket with the understanding that the profits from the lottery will be used to provide a public good. This increases the willingness to pay for lottery tickets in much the same way that the activities of the by-product firm increase the consumer's willingness to pay for the private good.

[9] Krugman's work builds in turn on Dixit and Stiglitz (1977).

[10] This runs counter to the standard result in the public goods literature. When the public good is normal, an increase in group size generally leads to an increase in provision, though provision asymptotically approaches a finite value as group size grows large. See Chamberlin (1974), McGuire (1974), and Andreoni (1988).

whole.[11] Mondal (2010) does not obtain the results present in the Pecorino (2009) paper. In particular, Mondal finds that public good provision is increasing in the size of the society, though it does approach a finite upper bound.

The current paper considers preferences over private goods which take the form $\left(\sum_{i=1}^{n} C_{ij}^{\theta}\right)^{\gamma}$, where $0 < \theta < 1$ and $0 < \gamma \leq 1$.[12] This generalizes the preferences used in Pecorino (2009) and allows for diminishing marginal utility for private goods as a whole. The preferences in Pecorino (2009) are a special case of those considered here, with $\gamma = 1$.

3. Voluntary Contributions

I will first develop the model under the voluntary contributions mechanism and discuss its properties. Then, in Section 4, I will develop the model when the public good is provided by by-product firms.

3.1. Consumers

There are identical consumers indexed by $j = 1, \ldots, L$. Goods are indexed by $i = 1, \ldots .n$, and consumption of the i^{th} variety by person j is denoted by C_{ij}. Consumers have the utility function

$$U_j = \left(\sum_{i=1}^{n} C_{ij}^{\theta}\right)^{\gamma} + G(S/w), \tag{1}$$

[11] In Pecorino's (2009) specification, there is diminishing marginal utility to consuming an individual variety, but a constant gain in utility from consuming a given amount of a variety not previously consumed. In Mondal, the gain from consuming a given amount of a variety not previously consumed diminishes with the level of consumption of existing varieties.

[12] After completing the first draft of this paper, I came across independent work by Bag and Mondal (2010) which also addresses the issues raised in Pecorino (2009) by utilizing a different utility function. In particular, these authors place the subutility function for private goods and the public good inside of a CES function. When the elasticity of substitution between the public good and private goods is less than 1, they overturn Pecorino's (2009) result, finding that public good provision is monotonically increasing in group size. When the elasticity of substitution between the public good and private goods is greater than one, they find a 'U' shaped relationship under which provision initially increases in the size of the society, but then decreases. The results in my paper are broadly consistent with their results for when the elasticity of substitution between the public good and private goods is greater than one.

where $0 < \theta < 1$, and $0 < \gamma \leq 1$. The function *G(S/w)* reflects the utility gained from consumption of the public good, where *S* is total contributions to the public good and *w* is the wage rate. The total labor hired to produce the public good is *S/w*. The function *G* exhibits the following properties: $G(0) = 0$, $G' > 0$, $G'' < 0$, $G'(0) = \infty$, $G'(\infty) = 0$, and *G'* is finite for $S/w > 0$. The assumptions that $G'(0) = \infty$ and $G'(\infty) = 0$ ensures that the model has an interior equilibrium with a finite level of public good provision.

Each individual contributes s_j to the public good so that $S = \sum_{j=1}^{L} s_j$. Each individual is endowed with a single unit of labor, and labor is the only source of income in the model.[13] Thus, each individual has an income of w. Individuals maximize their utility subject to the following budget constraint:

$$w = \sum_{i=1}^{n} P_i C_{ij} + s_j \,, \tag{2}$$

where P_i denotes the price of good *i*.

The first order conditions to the consumer's problem imply

$$P_i = \frac{\gamma \theta C_i^{\theta - 1}}{\lambda_j \left(\sum_{i=1}^{n} C_i^{\theta} \right)^{1-\gamma}} \,, \text{ and} \tag{3}$$

$$(1/w) G'(S/w) = \lambda_j \,, \tag{4}$$

where λ_j is the Lagrangian multiplier for person *j* and is interpreted as the marginal utility of income. Because all individuals are identical, there will be a unique interior Nash equilibrium at

[13] In this model, the private good sector is monopolistically competitive, and for-profit firms are subject to a zero profit condition. In a subsequent section of the paper, I will introduce by-product firms. These firms will earn positive profits, but they will devote these profits towards production of the public good. Thus, individuals in this paper never receive profit income which they can spend.

which $s_j = s \ \forall j$.[14] Each person faces the same income and prices, so in equilibrium, $C_{ij} = C_i \ \forall j$ and $\lambda_j = \lambda \ \forall j$. I will use these substitutions in the analysis below, where appropriate.

3.2. Firms

Private goods are produced in a monopolistically competitive sector, which is based on Krugman (1980, 1981). The total number of varieties n is endogenously determined. Each firm in the model produces a unique variety, with firm level output denoted by X_i. Each good is produced with only labor. Let l_i be the labor used to produce X_i. Each variety has a set up cost which requires α units of labor. The set-up cost implies that production involves a fixed but avoidable cost, since the set up cost is not incurred at a 0 level of production. Each unit of X_i requires β units of labor, where β is a constant . Thus we have

$$l_i = \alpha + \beta X_i \text{, for } X_i > 0 \text{ and}$$
$$l_i = 0 \text{, for } X_i = 0 . \qquad (5)$$

The profit function for firm i is

$$\pi_i = P_i X_i - \alpha w - \beta w X_i . \qquad (6)$$

Since consumers are identical, we have

$$X_i = LC_i . \qquad (7)$$

The solution for C_i may be found from (3). I will follow Krugman (1981: 972) and assume that with many firms, each individual firm will take the denominator of (3) as given when choosing a profit maximizing price.[15]

[14] See Bergstrom et al. (1986, pp. 32-34) and Cornes and Sandler (1989, p. 245).

[15] Mondal (2010) also follows this assumption. In what follows, I obtain the same solutions for prices, consumption and output as these two authors. As the number of firms in the industry becomes large, the effect that any one firm's price setting has on the denominator of (3) goes to zero.

There is free entry into the market, so in equilibrium, firm profit in (6) equals 0. Profit maximization by the firms, plus the zero profit condition and equations (3) and (7) imply the following solutions for the model:

$$P_i / w = \beta / \theta, \; i = 1, \; \ldots\ldots, \; n. \tag{8}$$

$$X_i = \frac{\alpha\theta}{\beta(1-\theta)}, \; i = 1, \; \ldots\ldots, \; n. \tag{9}$$

$$C_i = \frac{\alpha\theta}{L\beta(1-\theta)}, \; i = 1, \; \ldots\ldots, \; n. \tag{10}$$

Because of the symmetry in the model, price, consumption and output are the same across all goods. Equation (8) gives the price of goods measured in units of labor. To simplify the notation, I use the normalization $w = 1$.

The total labor employed producing private goods is $L_P = \sum_i^n \left(\alpha + \beta X_i\right) = n\left(\frac{\alpha}{1-\theta}\right)$, where use has been made of (9). Total labor used to produce the public good is $L_G = S$.[16] By labor market clearing, $L_P + L_G = L$. Substituting for L_P and L_G and solving for n yields:

$$n = \frac{(1-\theta)}{\alpha}(L - S). \tag{11}$$

Using (8), (10), and (11) in (3), we may obtain the following solution for λ:

$$\lambda = AL^{1-\theta\gamma}(L-S)^{\gamma-1}, \text{ where } A = \gamma\theta\left(\frac{\theta}{\beta}\right)^{\theta\gamma}\left(\frac{1-\theta}{\alpha}\right)^{\gamma(1-\theta)}. \tag{12}$$

[16] With the wage normalized to 1, the amount of labor hired to produce the public good equals the total amount of contributions S.

The parameter λ reflects the marginal utility of private consumption, and therefore represents the opportunity cost of contributing to the public good.

3.3. Comparative Statics of the Voluntary Contributions Mechanism

The key comparative static of the model concerns the effect of increasing the size of the society, *L* on contributions towards (and provision of) the public good. Totally differentiate (4) and (12) to obtain the following:

$$\frac{dS}{dL} = \frac{\lambda[(1-\theta\gamma)(S/L)-\gamma(1-\theta)]}{(1-\gamma)\lambda-(L-S)G''(S)}. \tag{13}$$

The denominator is positive, since $G''(S) < 0$. Also note that $S < L$.[17] The sign of the comparative static depends upon the sign of the term in brackets in the numerator. This leads directly to Result 1.

<u>Result 1</u>: The sign of *dS/dL* is the same as the sign of $(1-\theta\gamma)(S/L)-\gamma(1-\theta)$.

Note that *dS/dL* will tend to be positive if γ is small and θ is large. When γ is small, there is strong diminishing marginal utility for private goods as a group, compared with the public good. This is consistent with λ falling as *L* increases. Note from (4) that $dS/dL = (1/G''(S))(d\lambda/dL)$, so *S* can rise with *L* only if λ falls. When θ is large, the private goods are highly substitutable for one another. This reduces the extent to which λ will tend to rise when more varieties become available.

Under result 1, we may have $dS/dL > 0$ a result which is not possible in Pecorino (2009). This occurs because of the generalization of preferences which allow for a diminishing marginal utility for private goods as a group. For a sufficiently large group, however, it turns out that

[17] Since the wage is normalized to 1, *S* is the amount of labor devoted to producing the public good. Since at least some labor is used up in the production of private goods, we must have $S < L$.

$dS/dL < 0$ and that S approaches 0 as group size L approaches infinity. This occurs, because in a sufficiently large group, λ is increasing in L. To see this, first note that the elasticity of contributions with respect to the size of society, $(dS/dL)(L/S)$, is less than one.[18] This implies that the ratio S/L falls towards 0 as L grows large. As a result, $(1-\theta\gamma)(S/L)-\gamma(1-\theta)$ must become negative as L approaches infinity. This, plus Result 1 yields Result 2:

> **<u>Result 2</u>:** For L sufficiently large, contributions S and provision of the public good $G(S)$ are decreasing in group size L.

Since S is growing small relative to L, from (12) we have $\lambda \approx AL^{\gamma(1-\theta)}$, when L is large. Thus, λ will grow without bound in L. As L grows large, (4) cannot hold for $S > 0$, because G' is finite for $S > 0$. Thus, both S and $G(S)$ must approach 0 as L grows large. This is summarized as Result 3:

> **<u>Result 3</u>:** Contributions S and provision of the public good $G(S)$ both approach 0 as L approaches infinity.

The results of Pecorino (2009) do not completely generalize, but the large group results presented in Results 2 and 3 are consistent with this earlier work. These results are obtained, because for a sufficiently large society, λ is increasing in the size of the society. Since λ reflects the marginal utility of private consumption, when λ is higher, so is the opportunity cost of contributing to the public good. Moreover, since λ rises to infinity as society grows large, the provision of the public good goes to zero.

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[18] Multiply both sides of equation (13) by L/S. It is then possible to show that the right-hand side of the resulting equation is less than one. In verifying this, please recall that $S < L$.

Why does λ eventually increase with L? From (3), we have $\lambda_j = \gamma\theta C_i^{\theta-1} / P_i \left(\sum_{i=1}^{n} C_i^{\theta} \right)^{1-\gamma}$.

There are two main factors driving the relationship between L and λ. As L increases, consumption of each variety falls (see equation (10)) and this increases λ by increasing the numerator of the expression above. On the other hand, overall consumption expands as L increases, and this reduces λ by increasing the denominator of the expression above. In a large society, the first effect dominates, and as a result, λ is increasing in L.[19] The increase in λ in a large society is driven by the greater variety of private goods which are available in such a society.

The main importance of Results 2 and 3 is to provide a backdrop for the results of the model with by-product firms.[20] In particular, the model presented here leads to an environment in which the voluntary contributions mechanism totally fails in a large group. As we shall see, in this same setting, by-product firms are much more effective in providing the public good when the size of the society is large.

The welfare effects of an increase in L on the representative consumer are ambiguous. To see this, substitute the solutions for n and C into equation (1). If we denote the resulting expression as W (for welfare) we find the following:

$$\frac{dW}{dL} = \frac{\lambda}{\theta L^2}\left[(1-\theta)L + \theta S\right] + \left(G' - \frac{\lambda}{\theta L} \right)\frac{dS}{dL}. \qquad (14)$$

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[19] Algebraically (see equation (12)), this result relies on the fact that S grows small relative to L in a large society. In a small society, S may be fairly close in size to L. As a result, increases in L in a small society may lead to fairly large percentage increases total private consumption. Thus, in a small society, the denominator of the solution for λ may grow faster than the numerator. If this occurs, then λ will be decreasing in L.

[20] Certainly there are alternative specifications of the model which would not yield Results 2 and 3. In particular, these results depend upon the fact that the marginal utility of consuming a private good rises without bound as consumption of that good approaches zero. Also, see the discussion of Bag and Mondal (2010) in footnote 12.

From (4), $G' = \lambda$. If $\theta L > 1$ (which will be true in a large group), then $dS/dL > 0$ is sufficient to ensure that welfare increases with L. In this case, both the number of varieties and the provision of the public good would increase in L. However since we may have $dS/dL < 0$ (and will have $dS/dL < 0$ for L sufficiently large), the welfare effect of increasing L is ambiguous in general. While larger societies will have more private goods to choose from, they may also have less of the public good.

3.4. The Optimal Level of Provision

For future reference, it will be useful to derive the condition for the optimal provision of the public good. To do this, I will maximize welfare in (1) with respect to public good provision, while taking the distortion from the existence of monopolistic competition as given.[21] This optimization implies the following:

$$LG'(S) = \lambda. \tag{15}$$

The left-hand side is the sum of the marginal benefits from providing the public good, while the right-hand side is the marginal cost of provision. Denote the solution to equation (15) as S^o. It is straightforward to show the $dS^o/dL > 0$. Even though the opportunity cost of provision λ rises without bound, the optimal level of provision is still increasing in group size.

4. By-product Firms

4.1. The Model

Next, we will use the same basic structure as before, but add by-product firms to the model. A by-product firm uses the profits it earns from selling the private good to provide the public good.

[21] Given the structure of the model, it does not matter how I treat the distortions relating to monopolistic competition. See the discussion in Pecorino (2009, p. 304, footnote 10.)

I will assume that direct contributions are zero (i.e., $s_i = 0 \ \forall i$) and then show that in equilibrium no individual would want to make a direct contribution. Of the n firms in the monopolistically competitive industry, firms indexed $i = 1,...,m$ are by-product firms and firms indexed $i = m+1,...n$ are for-profit firms. Total contributions towards the public good are determined by the sum of the profits of the by-product firms as follows:

$$S = \sum_{i=1}^{m} \pi_B^i, \tag{16}$$

where π_B^i denotes the profits of byproduct firm i.

Since the wage is normalized to 1, the marginal cost of production is constant at β. When a consumer pays the price P_i to a by-product firm, she recognizes that $P_i - \beta$ is contributed towards the public good. This gives the consumer a benefit of $(P_i - \beta)G'(S)$. With this in mind, the first order conditions to the consumer's problem may be expressed as follows:[22]

$$P_i = \frac{\gamma\theta C_i^{\theta-1}}{\lambda\left(\sum_{i=1}^{n} C_i^{\theta}\right)^{\gamma-1}} + \frac{G'(S)}{\lambda}(P_i - \beta),\ i = 1,....m, \text{ and} \tag{17}$$

$$P_i = \frac{\gamma\theta C_i^{\theta-1}}{\lambda\left(\sum_{i=1}^{n} C_i^{\theta}\right)^{\gamma-1}},\ i = m+1,...n. \tag{18}$$

The willingness of consumers to pay for a private good from a by-product firm reflects their marginal valuation of the private good plus their valuation of the contribution made towards provision of the public good. As before (and again following Krugman (1981)) I assume that

[22] The expressions below reflect the fact that $\lambda_j = \lambda \ \forall j$ in equilibrium, and the normalization $w = 1$.

firms take $\lambda\left(\sum_{i=1}^{n} C_i^{\theta}\right)^{\gamma-1}$ as given when they set their profit maximizing price. All firms set prices to maximize profits and firms *i = m+1,…n* are subject to a zero profit condition due to free entry.[23] This plus the conditions in (7), (17) and (18) yield the following solutions for the model:

$$P_i = \left(\frac{\beta}{\theta}\right)\left(\frac{\lambda - \theta G'(S)}{\lambda - G'(S)}\right), i = 1,\ldots m, \tag{19}$$

$$P_i = \left(\frac{\beta}{\theta}\right), i = m+1, \ldots.n, \tag{20}$$

$$C_i = \frac{\alpha\theta}{L\beta(1-\theta)}, i = 1,\ldots n, \tag{21}$$

$$X_i = \frac{\alpha\theta}{\beta(1-\theta)}, i = 1,\ldots n. \tag{22}$$

Because θ < 1, the price charged by the by-product firms in (19) exceeds the price charged by the for-profit firms in (20). Production for the by-product firm and the for profit firm are equal.[24] The solution for the number of firms is the same as in (11). Using this and the other model solutions we can obtain the same solution for λ as in equation (12). Since the by-product firms are symmetric, they will each earn the same level of profits π_B in equilibrium. Thus, we can write total contributions towards the public good as $S = m\pi_B$. Use this to express λ as follows:

$$\lambda = AL^{1-\theta\gamma}(L - m\pi_B)^{\gamma-1}. \tag{23}$$

[23] By maximizing profits, the by-product firm is maximizing the contribution towards the public good. To the extent that the manager of the by-product firm is ideologically motivated (i.e., is a high demander for the public good), we would expect her to pursue such a strategy. See the discussion in Pecorino (2001, pp. 385-6, 2010, p. 123).
[24] This result is also found in Pecorino (2001, 2010). For intuition for why this result holds, see Pecorino (2001, pp. 386-387).

Using the profit function in (6) plus equations (19) and (22), we can obtain the following expression for profits for an individual by-product firm:

$$\pi_B = \frac{\alpha G'(m\pi_B)}{\lambda - G'(m\pi_B)}. \tag{24}$$

There will be a unique value of π_B which solves (24).[25] Equation (24) is obviously not a full solution for π_B, since it appears on both the left and right-hand side of the equation. A key intuition from (24), however, is that other things equal, increases in λ will cause a decrease in by-product profits. A higher value of λ raises the opportunity cost of paying a premium for private goods produced by the by-product firm.

Equation (24) may be rearranged to obtain the following:

$$G'(m\pi_B) = \frac{\pi_B}{(\alpha + \pi_B)}\lambda. \tag{25}$$

It is useful to note in signing the comparative static terms to follow, that $G'(m\pi_B) < \lambda$ under the by-product mechanism. Under voluntary contributions, $G'(m\pi_B) = \lambda$ in equilibrium. The fact that $G'(m\pi_B) < \lambda$ under the by-product mechanism combined with the shape of the G function implies that public good provision is higher under by-product lobbying than under voluntary contributions.[26] Also, with $G'(m\pi_B) < \lambda$, an individual would not make a direct contribution to

[25] To see this note that G' is decreasing in π_B and λ is increasing in π_B. $G'(0) = \infty$, but at some positive value of π_B we will have $G' = \lambda$. At this point, the right-hand side of (24) is infinite, while the left-hand side is finite. Further increases in π_B cause the left-hand side to monotonically increase and the right-hand side to monotonically decrease. Since $G'(\infty) = 0$, the right-hand side can fall as much as necessary to insure that there is a unique value of π_B where the two sides are equal.

[26] There is a simple proof by contradiction. Suppose total contributions under the by-product mechanism were less than or equal to contributions under the voluntary contributions mechanism. A comparison of (12) and (23) then implies a lower value of λ in the model with by-product firms. But a lower value of λ implies a higher level of

the public good even if she were given the opportunity to do so.[27] This justifies the assumption that direct contributions are zero in the presence of by-product firms. The comparative statics can be computed from (21) and (22), but also note that the sum of profits for all the by-product firms is $m\pi_B$.

4.2. The Effect of an Increase in L

Consider first an increase in the size of society L, while holding the number of by-product firms m constant. The effect on per firm profits is as follows:

$$\frac{d\pi_B}{dL} = \frac{\pi_B \lambda \left[(1-\theta\gamma)(m\pi_B / L) - \gamma(1-\theta) \right]}{(1-\gamma)m\pi_B\lambda + (L - m\pi_B)\left(\lambda - G'(m\pi_B) - (\alpha + \pi_B)G''(m\pi_B)\right)} . \qquad (26)$$

The denominator is positive. (Keep in mind that $G'' < 0$, $\lambda > G'$, and $m\pi_B < L$.) Result 4 immediately follows:

Result 4: The sign of $d\pi_B/dL$ is the same as the sign of $(1-\theta\gamma)(m\pi_B / L) - \gamma(1-\theta)$.

This is essentially the same condition for the sign of dS/dL in the voluntary contributions model. (See Result 1.) In addition, the large group results are the same as in the voluntary contributions model. It is straightforward to show that $(d\pi_B/dL)(L/\pi_B) < 1$. Thus, as L rises without bound, the ratio π_B/L will fall to zero and $d\pi_B/dL$ must become negative. With m constant, this implies that $d(m\pi_B)/dL < 0$ in a sufficiently large group.

Result 5: When m is constant and L is sufficiently large, total profit of the by-product firms $m\pi_B$ and provision of the public good $G(m\pi_B)$ are decreasing in group size L.

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contributions from (25) as compared with (4). This contradicts the initial premise. Pecorino (2001, 2010) also finds that contributions are higher with by-product firms compared with the voluntary contributions mechanism.

[27] At an interior equilibrium, the first order condition for direct contributions requires $G' = \lambda$. When $G'(m\pi_B) < \lambda$, the opportunity cost of the first unit of direct contributions exceeds the marginal benefit of the contribution.

Result 5 contrasts with the findings of Pecorino (2001), where the marginal utility of income is implicitly held constant. In that paper, when the public good is provided by a by-product firm, the level of provision is invariant to the size of the group.

Since π_B is growing small relative to L, in a large group we have $\lambda \approx AL^{\gamma(1-\theta)}$. Once again, λ grows without bound in L. This implies from (24) that profit per by-product firm must fall to zero as L grows large. Suppose we had $\pi_B > 0$. Then $G'(m\pi_B)$ would be finite, and by (24), we would have $\pi_B = 0$, contradicting the initial assumption $\pi_B > 0$. Since m is constant, this implies that total by-product firm profits and provision of the public good must fall to 0 as L grows large. This is summarized as follows:

<u>Result 6</u>: When m is constant, total by-product profit and provision of the public good $G(m\pi_B)$ both approach 0 as L approaches infinity.

As with the voluntary contributions mechanism, the by-product mechanism fails totally in a large group, if we hold the number of by-product firms constant. The reason for this failure is that a larger society has a higher marginal utility of income. This reduces consumer's willingness to pay for a public good via the premium they pay for private goods produced by a by-product firm.

4.3. Effects of an Increase in m

Next consider the effects of increasing the number of by-product firms m, while holding L constant. Since the number of by-product firms is changing, we need to compute both $d\pi_B/dm$ and $d(m\pi_B)/dm$. Using (23) and (24) we obtain the following:

$$\frac{d\pi_B}{dm} = \frac{-\pi_B\left[\lambda(1-\gamma)\pi_B - (L - m\pi_B)(\alpha + \pi_B)G''(m\pi_B)\right]}{(1-\gamma)m\pi_B\lambda + (L - m\pi_B)\left(\lambda - G'(m\pi_B) - (\alpha + \pi_B)G''(m\pi_B)\right)} < 0 \qquad (27)$$

$$\frac{d(m\pi_B)}{dm} = \frac{\pi_B[L - m\pi_B][\lambda - G'(m\pi_B)]}{(1-\gamma)m\pi_B\lambda + (L - m\pi_B)\big(\lambda - G'(m\pi_B) - (\alpha + \pi_B)G''(m\pi_B)\big)} > 0\,. \qquad (28)$$

(Recall, $G' < \lambda$, $m\pi_B < L$, and $G'' < 0$.) Thus while profit per firm falls, total profits of the by-product firms, and therefore total provision of the public good, increase in the number of by-product firms. This is summarized as Result 7:

> **Result 7:** An increase in the number of by-product firms m raises total profits of the by-product firms $m\pi_B$ and increases the provision of the public good $G(m\pi_B)$.

There is an analogous result in Pecorino (2010). By-product firms succeed because of the feedback between the consumer's willingness to pay for the private good and the mark up of price over marginal cost. Consumers know that the gap between price and marginal cost will go towards purchase of the public good and this raises their willingness to pay. A greater willingness to pay for the private good leads, in turn, to an increase in the mark up of price over marginal cost. Thus, there is a positive feedback effect between the consumer's willingness to pay, and the mark up of price over marginal cost. The mark up of price over marginal cost acts as a lever for increasing contributions towards the public good. When a by-product firm is added to the market, there is an additional lever to exploit, and this allows total profits of the by-product firms (and total contributions towards the public good) to increase.

To better understand how this works, consider the following example. Suppose in equilibrium that a consumer values a \$1 contribution towards the public good at \$.20, that her underlying willingness to pay for the private good is \$10, and that the marginal cost of production is \$6. If the firm charged \$10, there would be a \$4 gap between price and marginal cost. This is donated to the public good and the consumer values this donation at \$.80. Thus, the donation raises her willingness to pay to $10.80, and the by-product firm could charge this price. However, now the gap between price and marginal cost is $4.80 leading to a donation towards the public good valued at $.96, implying that the firm could charge $10.96. Each round this feedback effect is smaller, and eventually there is convergence to a price which equals the consumer's willingness to pay for the private good plus her valuation of the resulting donation to the public good. In this example, this price would be $11. This reflects the willingness to pay $10 for the private good, plus a valuation of $1 of the resulting $5 donation towards the public good.

While we can compute the effect on public good provision of an increase in *m*, it is not valid to let *m* grow without bound while *L* is held constant. The number of by-product firms must be less than or equal to the total number of firms *n*. If *m* grows without bound with *L* held constant, this condition would be violated. In the next section, we consider simultaneous increases in *m* and *L*.

4.4. Simultaneous Increases in *L* and *m*

It seems reasonable to assume that as the society increases in size, the number of by-product firms will increase proportionally. This assumption is captured by the following equation:

$$m = \sigma L\,, \tag{29}$$

where σ is a positive fraction. Let $\overline{\pi}_B$ be the highest level of profits earned by a by-product firm over all possible values of *L*. Then making use of the solution for *n* in (11), the condition $\sigma < (1-\theta)/(\alpha + (1-\theta)\overline{\pi}_B)$ will guarantee that the number of by-product firms is always less than the total number of firms producing the private good.

Again, we need to distinguish between the effect of L on the profits of an individual by-product firm, $d\pi_B/dL$ and the effect on total profits for all by-product firms, $d(\sigma L\pi_B)/dL$. Using (23), (24) and (29) we may obtain the following:

$$\frac{d\pi_B}{dL} = \frac{-\pi_B(1-\sigma\pi_B)\left[\gamma(1-\theta)\lambda - \sigma L(\alpha+\pi_B)G''(\sigma L\pi_B)\right]}{L\left[(1-\gamma)\pi_B\lambda\sigma + (1-\sigma\pi_B)\left(\lambda - G'(\sigma L\pi_B) - \sigma L(\alpha+\pi_B)G''(\sigma L\pi_B)\right)\right]} < 0. \tag{30}$$

$$\frac{d(\sigma L\pi_B)}{dL} = \frac{\sigma\pi_B\lambda\left[(1-\sigma\pi_B)\left(\left(1-\gamma(1-\theta)\right) - \left(\pi_B/(\alpha+\pi_B)\right)\right) + (1-\gamma)\sigma\pi_B\right]}{\left[(1-\gamma)\pi_B\lambda\sigma + (1-\sigma\pi_B)\left(\lambda - G'(\sigma L\pi_B) - \sigma L(\alpha+\pi_B)G''(\sigma L\pi_B)\right)\right]}. \tag{31}$$

In deriving (31), G' has been eliminated from the numerator by substituting from (25). From (30), profit per firm unambiguously falls when L increases. The effect on total profits, in (31), is ambiguous. The denominator of (31) is positive. A sufficient condition for total profits to rise is $\left(1-\gamma(1-\theta)\right) > \pi_B/(\alpha+\pi_B)$. This is stated as Result 8:

> **<u>Result 8</u>:** Assume the number of by-product firms is proportional to L. The condition $\left(1-\gamma(1-\theta)\right) > \pi_B/(\alpha+\pi_B)$ is sufficient to ensure that total by-product firm profit, and therefore total provision of the public good, is increasing in L.

To get further insight, note that π_B must fall towards 0 in a large group. To see this, use (24) and (29) to get

$$\pi_B = \frac{\alpha G'(\sigma L\pi_B)}{\lambda - G'(\sigma L\pi_B)}. \tag{32}$$

Suppose $\pi_B > 0$. Then $\sigma L\pi_B$ must approach infinity as L grows large. Since $G'(\infty) = 0$, from (32) this implies that $\pi_B = 0$. This contradicts the assumption $\pi_B > 0$. Thus individual firm profits must go to 0 in a large group. This has two additional implications. First, from (23) and

(29) we have, $\lambda \approx AL^{\gamma(1-\theta)}$ in a large group. Thus, λ rises without bound and approaches infinity at the rate $\gamma(1-\theta) < 1$. This implies that λ grows more slowly than *L*, a fact which will be important to the analysis below. The second implication is that for large *L*, the sufficient condition in Result 8 must be met because π_B approaches 0. This leads to Result 9.

> **Result 9:** Assume the number of by-product firms is proportional to *L*. In a sufficiently large group, $d(\sigma L\pi_B)/dL$ must be positive. Thus, provision of the public good is increasing in *L*, when *L* is sufficiently large.

Result 9 stands in opposition to Result 2 for the voluntary contributions mechanism, under which total contributions are decreasing in *L* for a sufficiently large group. This result suggests a advantage in providing public goods via by-product firms compared with the voluntary contributions mechanism.

Result 9 establishes that total by-product profits are increasing in group size for a sufficiently large group, but we would like to know whether these profits are bounded as group size increases. To address this issue, use (24) and (29) to obtain

$$\sigma L\pi_B = \frac{\sigma L\alpha G'(\sigma L\pi_B)}{\lambda - G'(\sigma L\pi_B)}. \quad (33)$$

Total profits are on the left-hand side of (33). By the equality in (33), I can focus on the magnitude of the right-hand side of this equation as *L* grows large. A simple proof by contradiction will demonstrate that profits cannot be bounded as *L* grows large.[28] Suppose that profits are finite in a large group. As a result, *G'* will approach a finite constant. Recalling that

[28] Keep in mind that once society is sufficiently large, further increases in *L* lead to a monotonic increase in total profits. Thus, cycling in the level of profits will not occur as *L* approaches infinity. The only two possibilities are that total profits asymptotically approach an upper bound or that they rise without bound in *L*.

$\lambda \approx AL^{\gamma(1-\theta)}$, the right-hand side of (33) is approximately $ZL^{1+\theta\gamma-\gamma}$ in a large group, where Z is a constant. Thus, both the right-hand side of (33) and total profits will approach infinity as L grows large. This contradicts the initial assumption that total profits were finitely bounded. Thus we can conclude, as stated in Result 10, that total profits rise without bound in L:[29]

> **<u>Result 10</u>:** Assume the number of by-product firms is proportional to L. The total profit of the by-product firms $\sigma L \pi_B$ will rise without bound as L grows large.

Even more so than Result 9, Result 10 underscores the effectiveness of by-product firms in supplying public goods for a large society. The fact that the level of provision rises without bound indicates that by-product firms perform quite well in large groups. In this same environment, the voluntary contributions mechanism fails totally. Why do we obtain this positive result? From our previous results, we know that there are two forces in play as the group size increases. Increases in λ reduce provision of the public good, other things held equal. This is reflected in Results 5 and 6. Opposing this is the effect of increasing the number of by-product firms. From Result 7, we know that this leads to an increase in the provision of the public good, when the size of the society is held constant. Results 9 and 10 show that in a large group, the positive effect of an increase in the number of by-product firms dominates the negative effect stemming from increases in λ. The reason this occurs is that λ grows more slowly than L, while the number of by-product firms is proportional to L.[30]

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[29] Note that equation (33) implies no necessary contradictions if we assume that total profits rise to infinity as L rises without bound.

[30] Suppose that we replace equation (29) with $m = \sigma L^{\eta}$, where $0 < \eta \leq 1$. It can be shown that total by-product profits rise without bound as L grows large if $\eta > \gamma(1-\theta)$. If $\eta < \gamma(1-\theta)$ total profits will fall to zero as L grows large. As long as $\eta > \gamma(1-\theta)$, the number of by-product firms grows faster than λ in the limit as L grows large, and Result 10 will continue to hold.

It can also be shown that welfare must be increasing in *L* in a sufficiently large group. The derivative *dW/dL* may still be expressed as in (14). Substitute for *G'* from (25) to express this as follows:

$$\frac{dW}{dL} = \frac{\lambda}{\theta L^2}\left[(1-\theta)L + \theta S\right] + \frac{\lambda}{\theta L(\alpha + \pi_B)}\left(\theta L \pi_B - (\alpha + \pi_B)\right)\frac{dS}{dL}. \qquad (34)$$

It has already been shown that $\sigma L \pi_B$ rises without bound in *L*, so the same must be true for $\theta L \pi_B$. Therefore the coefficient on *dS/dL* must be positive in a sufficiently large group. Since *dS/dL* is positive when *L* is large, this guarantees that *dW/dL* is positive in a sufficiently large group. This is summarized as Result 11:

Result 11: For a sufficiently large group, welfare is increasing in *L*.

While the by-product firm mechanism performs well in a large group, there is no presumption that provision will be optimal or close to optimal. The condition for an optimal provision of the public good is the same as in (15). This may be expressed as

$$LG'(S^o) = \lambda. \qquad (35)$$

The equilibrium relationship from (25) may be expressed

$$\left((\alpha + \pi_B)/\pi_B\right)G'(S) = \lambda. \qquad (36)$$

For both (35) and (36), a larger coefficient on *G'* will imply that the equation is solved by a higher value of *S*. The coefficient in (35) is greater than the coefficient on (36) if $L\pi_B > \alpha + \pi_B$. Since $\sigma L \pi_B$ rises without bound, it follows that this condition will hold in a sufficiently large group. This implies that the optimal level of provision will exceed the equilibrium level of provision when group size is large. While the mechanism of producing public goods via by-product firms is superior to the voluntary contributions mechanism, there is no presumption than it can attain anything close to the optimal level of provision.

5. Discussion and Conclusion

The results of this paper indicate that by-product lobbying is a viable and potentially important mechanism of providing public goods. For managers of nonprofit firms, the results indicate that their firms can compete in monopolistically competitive private good markets and still generate a surplus to allocate toward the cause they promote. The result that by-product firms can compete against for-profit firms and earn profits to devote to a public good has proven quite robust. The ability of by-product firms to compete in this manner has been questioned by, among others, Stigler (1974).

The feedback mechanism (described in Section 4.3) is the key explanation for why by-product firms are successful in this model. In some cases, consumers who make a purchase of a private good from a non-profit may have only a vague idea of how the price of this good is related to the contribution to the public good. Thus, the non-profit may benefit by making the connection between the purchase price and the donation to the public good transparent. So, for example, the nonprofit could announce that $5 of the purchase price would be used to help preserve endangered species.[31]

Important issues remain to be addressed by future research. The number of by-product firms is treated as being exogenous in this model. Ultimately, more attention needs to be paid to

[31] This presumes that consumers do not systematically overestimate the percentage of the purchase price being used to fund public good provision. This suggests a possible field experiment in which some purchasers of goods from a non-profit are told the exact amount of each purchase which goes to support the non-profits activities, while others are given less specific information.

the entrepreneurs behind these firms and the reasons why they choose to compete in markets for private goods as a nonprofit entity. Presumably ideology plays a role. For example, we should expect that a person running an environmentally oriented nonprofit has a particularly strong taste for the environmental amenities provided by the nonprofit. Nevertheless, this issue requires attention in future work.[32]

A related issue concerns managerial incentives. In the model, it is simply assumed that the manager of the by-product firm turns over all profits towards production of the public good. In practice, there is the potential for opportunistic behaviors in which some of the profits are diverted for the benefit of the manager of the by-product firm.[33]

In the model, the number of private goods varies endogenously, but the number of public goods is fixed exogenously at 1. Suppose that new public goods become available as the society grows. If these enter additively in the utility function, then under the voluntary contributions mechanism, we will generate more first order conditions along the lines of equation (4). Other things equal, an increase in the number of public goods available would increase total contributions summed across all public goods. It will still be the case, however, that increases in the marginal utility of consumption will lower the contributions towards any individual public good. Thus, in a growing a society, Results 2 and 3 would still apply for particular public goods, but the effect on total contributions to all public goods would be ambiguous. Having multiple public goods would require making a distinction among by-product firms as to which public good they contributed to, but the basic mechanism by which by-product firms succeed in providing the public good should not change.

[32] For more on the incentives of a by-product manager, see the discussion in Pecorino (2001, pp. 385-6).
[33] See the analysis in Besley and Ghatak (2007, pp. 1652-3). To the extent that the manager has a strong ideological commitment to the provision of the public good, this may act as a check on opportunistic behavior. In addition, there could be legal sanctions for a manager who makes fraudulent claims about the by-product firm's activities.

In the model, the by-product firms are all nonprofits, as they each turn over all their profits towards the provision of the public good. It is quite common for for-profit firms to, for example, make charitable donations. A natural extension of the framework provided in this paper is to allow a for profit firm the opportunity to contribute some of its profits towards the provision of a public good. This could help determine the conditions, if any, that such activities would increase a firm's profits. Additional analysis along these lines should provide guidance to managers of for-profit firms regarding some of the likely effects of engaging in acts of corporate social responsibility. To the extent that it is consistent with profit maximization, this would undermine Friedman's (1970) critique of corporate social responsibility.

The basic mechanism of the by-product model should be amenable to testing in the lab. It should be possible to design a public goods experiment in which the purchase of a private good is linked to the provision of a public good which benefits an entire group. The data would reveal the extent to which consumers are willing to pay a premium for private goods linked to a public good. Moreover, the model presented here can provide a point estimate for how large the premium should be. Evidence of this sort could supplement the evidence from the field cited earlier which suggests that consumers are willing to pay a premium for private goods whose purchase is linked to a provision of a public good.

The results of the model are consistent with the idea that nonprofits can play a vital role in providing public goods for society. It should be noted that there is no presumption that these firms can provide an optimal quantity of the public good. However, by-product firms are effective in the sense that public good provision grows without bound in the size of the society as long as the number of by-product firms is proportional to the size of the society. This positive result for by-product firms is obtained in a setting in which the voluntary contributions mechanism totally fails to provide the public good in a large group. The failure of the voluntary contributions mechanism occurs because larger societies have more private goods to choose from, and this drives up the marginal utility of income. Clearly, if by-product firms can succeed in providing public goods in this setting, they would also succeed in a setting in which the marginal utility of income were constant or falling as group size increased.[34]

While the success of by-product firms does require some degree of market power, this success is consistent with a monopolistically competitive market structure. Thus, the degree of required market power is not high. Further, the model does not assume warm glow effects on the part of consumers purchasing goods from by-product firms, nor does it assume any technological advantage for by-product firms in providing the public good.[35] Other factors, such as the tax exempt status of non-profits, may also contribute towards a competitive advantage for by-product firms. To the extent these factors are present, the performance of by-product firms should be superior to that implied by my model.

[34] By-product firms can only replicate the voluntary contributions outcome under perfect competition, while provision exceeds the voluntary contributions level under monopolistic competition. However, for a fairly wide range of preferences, the marginal utility of income is increasing in the size of the society when there is monopolistic competition. For example, when the elasticity of substitution between the public good and private goods is greater than 1 in the Bag and Mondal (2010) analysis, the marginal utility of income is increasing in the size of the society for sufficiently large societies. Thus, the performance of the by-product mechanism in an environment with an increasing marginal utility of income is crucially important. As seen in this paper, the mechanism performs quite well in this environment.

[35] The absence of warm glow effects in the model is not meant to imply that these effects are unimportant, but rather to show that the by-product mechanism can function even in the absence of these effects. Adding warm glow effects to the model should only strengthen the conclusion that by-product firms are a viable mechanism for the provision of public goods in large groups.

References

Andreoni, J., 1988. Privately provided public goods in a large economy: The limits to altruism. Journal of Public Economics 35, 57-73.

Andreoni, J., 1989. Giving with impure altruism: applications to charity and Ricardian equivalence. Journal of Political Economy 97, 1447-1458.

Andreoni, J., 1990. Impure altruism and donations to public goods: a theory of warm glow giving. Economic Journal 100, 464-477.

Bag, P. K. and D. Mondal. 2010. Group size paradox and public goods: A characterization. Manuscript, Department of Economics, National University of Singapore.

Bagnoli, M., Watts, S.G., 2003. Selling to socially responsible consumers: competition, and the private provision of public goods. Journal of Economics and Management Strategy 12, 419-445.

Baron, D. P., 2001. Private politics, corporate social responsibility, and integrated strategy. Journal of Economics and Management Strategy 10, 7-45.

Bergstrom, T., Blume L., Varian H., 1986. On the private provision of public goods. Journal of Public Economics 29, 25-49.

Besley, T., Ghatak, M., 2007. Retailing public goods: the economics of corporate social responsibility. Journal of Public Economics 91, 1645-1663.

Casadesus-Masanell, R., Crooke, M., Reinhardt, F., Vasishth, V., 2009. Households' willingness to pay for "green" goods: evidence from Patagonia's introduction of organic cotton sportswear. Journal of Economics and Management Strategy 18, 203-233.

Chamberlin, J., 1974. Provision of public goods as a function of group size. American Political Science Review 68, 707-716.

Cornes, R., Sandler T., 1984. Easy riders, joint production, and public goods. Economic Journal 94, 580-598.

Cornes, R., Sandler T., 1989. Public goods, growth and welfare. Social Choice and Welfare 6, 243-251.

Dixit, A. K., Stiglitz, J. E., 1977. Monopolistic competition and optimum product diversity. American Economic Review 67, 297-308.

Elfenbein, D. W., McManus, B., 2010. Greater price for a greater good? Evidence that consumers pay more for charity linked products. American Economic Journal: Economic Policy 2, 28-60.

Engers, M., McManus, B., 2007. Charity auctions. International Economic Review 48, 953-994.

Galarraga, I., Markandya, A. 2004. Economic Techniques to estimate the demand for sustainable products: A case study for Fair Trade and organic coffee in the United Kingdom. Economía Agraria y Recursos Naturales 4, 109-134.

Friedman, M. F., 1970. The social responsibility of business is to increase its profits. The New York Times Magazine, September 13, 1970.

Hiscox, M. J., Smyth, N. F. B., 2011. Is there consumer demand for fair labor standards? Evidence for a Field Experiment. Manuscript. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1820642.

Kotchen, M. J., 2006. Green markets and the private provision of public goods. Journal of Political Economy 114, 816-834.

Krugman, P. R., 1980. Scale economies, product differentiation, and the pattern of trade. American Economic Review 70, 950-959.

Krugman, P. R., 1981. Specialization and the gains from trade. Journal of Political Economy 89, 959-973.

Landry, C. E., Price, M. K. 2007. Earmarking lottery proceeds for public goods: Empirical evidence from U.S. lotto expenditures. Economics Letters 95, 451-55.

Mayer, W., 2002. On the efficiency of by-product lobbying. Public Choice 112, 275-292.

McGuire, M.C., 1974. Group size, group homogeneity, and the aggregate provision of a pure public good under Cournot behavior. Public Choice 18, 107-126.

Mondal, D., 2010. Public good provision under monopolistic competition. Manuscript, National University of Singapore.

Moore, T.G., 1961, The purpose of licensing. Journal of Law and Economics 4, 93-117.

Morgan, J., 2000. Financing public goods by means of lotteries. Review of Economic Studies 67, 761-84.

Olson, M., 1965. The Logic of Collective Action. Harvard University Press, Cambridge, MA.

Pecorino, P., 2001. Can by-product lobbying firms compete? Journal of Public Economics 82, 377-397.

Pecorino, P., 2009. Monopolistic competition, group size and public good provision. Economic Journal 119, 298-307.

Pecorino, P., 2010. By-product lobbying with rival public goods. European Journal of Political Economy 26, 114-124.

Posnett, J., Sandler, T., 1986. Joint supply and the finance of charitable activity. Public Finance Quarterly 14, 209-222.

Stigler, G. J., 1974. Free riders and collective action: an appendix to theories of economic regulation. Bell Journal of Economics and Management Science 5, 359-365.

Teisl, M. F., Roe, B., Hicks, R. L., 2002. Can eco-labels tune a market? Evidence from dolphin-safe labeling. Journal of Environmental Economics and Management 43, 339-359.