

Diakoulakis, Giorgos N.

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Monopolistic pricing with goal-driven consumers

Giorgos N. Diakoulakis*

Agricultural Economics Research Institute (AGERI), Aristeidi Kourtidou 56-58, Athens 111 45, Greece

Abstract

In this article, we theoretically explore monopolistic pricing when a (representative) consumer exhibits multiple goals.

Keywords: monopolistic firm, personalized pricing, goal-driven consumers

JEL: D42, D90, D21

1. introduction

The aim of this article is to contribute to the expanding body of literature on behavioral industrial organization ([Spiegler, 2011](#)) by investigating the impact of consumers' goal compliance on monopolistic pricing strategies.

Previous research has primarily focused on examining the influence of consumers' self-control issues on firms' decisions. For instance, [Gómez-Miñambres \(2015\)](#) explored how firms can attract consumers with inconsistent preferences due to temptation. The impact of temptation on optimal pricing has also been explored by [Esteban and Miyagawa \(2006\)](#) and [Esteban et al. \(2007\)](#). In a more recent study, [Li and Jiang \(2022\)](#) delved into the influence of present bias, another source of consumers' time inconsistency, on firms' pricing strategies.

This article diverges from this existing literature and delves into the influence of the goals exhibited by consumers on the type of monopolistic pricing—specifically, personalized versus perfect competitive. Our rationale is grounded in [Lindenberg \(2008\)](#) argument that states, "...people are likely to exhibit multiple goals, usually conflicting ones, the activation of which will affect

*Corresponding author

Email address: gdiakoulakis@elgo.gr (Giorgos N. Diakoulakis)

the type of information they seek, making their choices and the order of their alternative options consistent with their goal realization." In simpler terms, consumers' willingness to pay (WTP) or their inverse demand for a particular good or service is conditional on their preferences for goal compliance.

Specifically, we theoretically demonstrate that both the number of goals a consumer exhibits and whether the consumer's preferences for goal compliance are 'centralized' around a particular one can impact their WTP for a good or service. This, in turn, affects the monopolist's choice of pricing strategy to be imposed.

The structure of this article is as follows: Section 2 analyzes both the consumer's and the monopolist's behavior, while Section 3 draws implications and concludes.

2. The model

2.1. Basic assumptions

Consider a monopolist producing a good or service, denoted as $X = [0, 1]$, incurring a cost represented by the function $c(x)$, where $c : X \rightarrow \mathbb{R}_{\geq 0}$ is a cost function, with $c' > 0$ and $c'' > 0$ for any $x \in X$.

Additionally, our model incorporates a representative consumer marked by G distinct goals. For instance, [Lindenberg and Steg \(2007\)](#) identified three overarching goals related to environmental goods (e.g., organic products) and services (e.g., sustainable modes of transport): a gain goal (i.e., aimed at increasing wealth, status, etc.), a hedonic goal (i.e., focused on experiencing positive feelings), and a normative goal (i.e., centered around acting appropriately).

For each goal, denoted by $i = 1, 2, \dots, G$, we assume an *ideal* goal-consumption, $x_i^* \in X$, and a *preference for compliance*¹, denoted by $\gamma_i \in [0, 1]$. Notably, we assume that $\sum_{i=1}^G \gamma_i = 1$, indicating that the consumer has at least one goal they want to comply with, introducing a trade-off between goal compliance.

¹[Amaldoss and Harutyunyan \(2023\)](#) refer to γ as consumer's goal-sensitivity, whereas [Lindenberg \(2008\)](#) as the degree of centrality (or focality) of a particular goal.

2.2. Consumer's behavior

We formulate consumer's utility, denoted as u , derived from the consumption of X , following a similar approach as [Amaldoss and Harutyunyan \(2023\)](#):

$$u(x) = v(x) - px - \sum_{i=1}^G \gamma_i (x - x_i^*)^2 \quad (1)$$

Here, $v : X \rightarrow \mathbb{R}_{\geq 0}$ is a value function with $v' > 0$ and $v'' < 0$ for any $x \in X$, and $p > 0$ represents the market price of X . Particularly, the term $\sum_{i=1}^G \gamma_i (x - x_i^*)^2$ captures the *disutility* the consumer experiences from any deviation from the ideal goal-consumption, x_i^* .

Solving the consumer's utility maximization problem yields the *inverse demand*, p_D , over X :

$$p_D(x) = v'(x) - 2 \sum_{i=1}^G \gamma_i (x - x_i^*), \quad \frac{\partial p_D}{\partial x} < 0 \quad (2)$$

It's essential to note that $x \geq x_i^*$, and there might exist a level of consumption that the consumer selects only if incentivized to do so. By defining x_0 , such that $p_D(x_0) = 0$, and using (2), we establish that $p_D > 0$ for any $x < x_0$ and vice versa.

A noteworthy observation is that $(\partial x_0 / \partial x_i^*) > 0$, indicating that a higher ideal goal-consumption increases the likelihood of a positive consumer's inverse demand. For the rest of our analysis, we assume that $x_0 > 1$ and so, $p_D > 0$ for any $x \in X$.

Furthermore, from (2) we note that

Lemma 1. *Let G_L and G_H , such that $G_H > G_L$. Then, $p_D(x; G_H) \geq p_D(x; G_L)$.*

Proof. From (2) we have that $p_D(x; G_H) - p_D(x; G_L) = 2 \left(\sum_{i=1}^{G_H} \gamma_i x_i^* - \sum_{i=1}^{G_L} \gamma_i x_i^* \right) = 2 \sum_{i=G_L+1}^{G_H} \gamma_i x_i^* \geq 0$, with equality if $\gamma_i x_i^* = 0$ for all $i = G_L + 1, \dots, G_H$. \square

In words, Lemma 1 states that the more goals a consumer has, the higher is their WTP for consuming X .

Let's denote with g a particular goal, with x_g^* and γ_g its associated ideal goal-consumption and preference for compliance, respectively. Then:

$$\frac{\partial p_D}{\partial \gamma_g} = 2 \left[x_g^* + \sum_{i=1}^{G-1} \frac{\partial}{\partial \gamma_g} (\gamma_i x_i^*) \right] \quad (3)$$

Thus,

Lemma 2. *By assuming $x_i^* \approx \chi^*$ for any $i = 1, 2, \dots, G - 1$, we have that if $x_g^* > (G - 1)\chi^*$, then $(\partial p_D / \partial \gamma_g) > 0$.*

Proof. Note that $\sum_{i=1}^G \gamma_i = 1$ implies that $\frac{\partial}{\partial \gamma_g} \left(\sum_{i=1}^{G-1} \gamma_i \right) = \sum_{i=1}^{G-1} \frac{\partial \gamma_i}{\partial \gamma_g} = -1$. Thus, by replacing it on (3) we obtain the above condition. \square

In words, Lemma 2 says that the more oriented the consumer becomes towards a specific goal, their WTP increases, provided that the corresponding ideal goal-consumption is high.

Importantly, Lemma 2 emphasizes that the more goals the consumer has, the less likely is for their WTP to be increased as their preferences for compliance are 'centralized' around a particular goal. The rationale is that in such a case, the consumer should 'abandon' the pleasure of comply with the $G - 1$ goals. In order to be compensated for that loss, they require for the ideal goal-consumption of the goal under consideration to be sufficiently high.

Alternatively, rearranging the inequality in Lemma 2 we obtain the maximum numbers of goals the consumer should has for the 'centralization' to positively influence their WTP:

Lemma 3. *If $G < \bar{G}$, then $(\partial p_D / \partial \gamma_g) > 0$, with $\bar{G} = \frac{x_g^* + \chi^*}{\chi^*}$.*

It is essential to note that $(\partial \bar{G} / \partial x_g^*) > 0$ and $(\partial \bar{G} / \partial \chi^*) < 0$. In simpler terms, the higher is the ideal goal-consumption of the $G - 1$ goals, the fewer goals the consumer should has for the 'centralization' to positively affect their WTP. Figure 1 illustrates this observation.

The following proposition summarizes Lemmas 1–2:

Proposition 1. *The more goals the consumer has: (i) the higher is their WTP for purchasing X ; (ii) the less likely is for their WTP to be increased as their preferences for compliance are 'centralized' around a particular goal.*

2.3. Monopolistic pricing

The monopolist is aware that consumer's WTP for purchasing $x \in X$ is given by (2). However, to accurately determine the price level, the monopolist needs to observe and verify the consumer's profile, represented by the pair (x_i^*, γ_i) for any $i = 1, 2, \dots, G$.

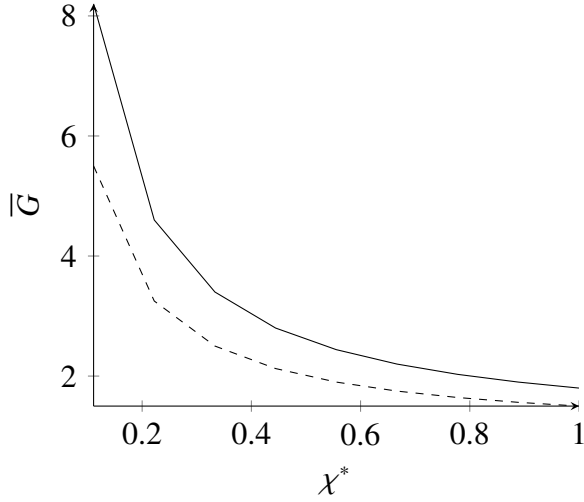


Figure 1: Goal threshold for a positive effect of 'centralization' on consumer's WTP, when $x_g^* = 0.8$ (straight line) and $x_g^* = 0.5$ (dashed line).

Let's assume the existence of a mechanism through which the monopolist can perfectly observe and verify consumer's profile. Consequently, for any $x \in X$ the monopolist's profits are:

$$\pi(x; \mu) = \mu[p_D(x)x - c(x) - z] + (1 - \mu)[p_C x - c(x)] \quad (4)$$

Here, $p_C > 0$ denotes the perfect competitive price, $\mu \in \{0, 1\}$ indicates whether the monopolist implements the mechanism ($\mu = 1$) or not ($\mu = 0$), and $z > 0$ is the implementation cost, with $(\partial z / \partial G) > 0$. This latter assumption encompasses the complexity associated with the identification of the consumer's profile.

The monopolist's optimal level of production is $\hat{x}(\mu) = \arg \max_{x \in X} \pi(x; \mu)$. Therefore, *personalized pricing* is weakly preferred over *perfect competitive pricing* iff $\phi \equiv \pi[\hat{x}(1); 1] - \pi[\hat{x}(0); 0] \geq 0$.

Few observations emanate here. Firstly, by differentiating ϕ with respect to G and utilizing the Envelope Theorem we have that:

Lemma 4. *If $\hat{x}(1) > \frac{\partial z / \partial G}{\partial p_D / \partial G}$, then $\frac{\partial \phi}{\partial G} > 0$.*

In simpler terms, Lemma 4 asserts that the monopolist's inclination to adopt personalized pricing strengthens as the consumer's number of goals increases. This is contingent on the condition that the production level, facilitated by the detection mechanism, surpasses the ratio of marginal cost to the marginal benefits associated with a consumer having multiple goals.

Secondly, $\hat{x}(1) \in X$, which implies that $\hat{x}(1) \leq 1$. Hence, if $(\partial z/\partial G) > (\partial p_D/\partial G)$, then personalized pricing is *incentive rational* if the consumer exhibits a small number of goals.

Third, a differentiation of ϕ with respect to γ_g yields that $\frac{\partial \phi}{\partial \gamma_g} = \left(\frac{\partial p_D}{\partial \gamma_g}\right)\hat{x}(1) \geq 0$. Therefore, by using Lemma 2 we have that the more goals a consumer has, the less favourable personalized pricing becomes, as the consumer's preferences for goal compliance are 'centralized'.

The subsequent proposition encapsulates the aforementioned discussion:

Proposition 2. *The favorability of personalized pricing increases with the number of goals a consumer has if: (i) the production level under the detection mechanism is high; (ii) the marginal cost of mechanism implementation is lower than the consumer's marginal WTP; (iii) goal compliance is not excessively 'centralized.'*

3. Implications and conclusion

In this article, we have delved into the behavior of a consumer exhibiting multiple goals, and two key implications have been highlighted concerning monopolistic pricing:

Firstly, the necessary but not sufficient condition for personalized pricing to be weakly preferable over perfect competitive pricing, especially when a consumer has numerous goals, is that the monopolist's (marginal) benefits from consumer identification must exceed the (marginal) cost associated with it. In scenarios with a substantial number of consumers, this benefit is expected to rise. If the process of identifying each consumer does not become overly complex, then personalized pricing is likely to dominate over the perfect competitive approach, especially when dealing with a large number of consumers, each characterized by an extensive set of goals.

Secondly, many monopolists commonly employ discount coupons as a mechanism to attract new customers. Such interventions are likely to amplify goal preferences, particularly those associated with personal gains and wealth, as indicated by [Lindenberg and Steg \(2007\)](#). Proposition 2 suggests that when discount coupons are employed, personalized pricing is likely to be less beneficial for the monopolist, especially when the consumer possesses a large number of goals.

Our analysis is static in the sense that we assume the consumer's goal compliance preferences remain constant over time. A more dynamic approach would enable us to address questions such

as "how long should the monopolist implement a discount coupon" and "do consumers make purchases at the beginning or end of a promotion campaign?" We leave these questions for future research.

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