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Competition and consumer choice in option demand markets

Gilad Sorek

Economics Department - Auburn University, Auburn, AL, United States

HIGHLIGHTS

- Two medical providers choose geographic location and medical-care specialization.
- Medical product are sold through insurance - on the option market.
- Multiple possible equilibria are characterized — with single and multiple purchases.
- The market may offer efficient, excessive, or insufficient level of consumer choice.
- Regulating geographic location properly can support market efficiency.

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ABSTRACT

Two medical providers choose their geographic location and medical-care specialization, and then compete in prices under health insurance sales. When buying insurance consumers know their geographic address, but they do not know their preferred medical treatment before getting sick. Hence, consumers may desire buying access-options for both providers, although eventually attending only one. I show that location and product choices in such option demand markets greatly differ from those obtained for corresponding spot markets and may yields efficient, excessive, or insufficient level of consumer choice in terms of product differentiation and geographic dispersion.

1. Introduction

This work analyzes two-dimensional spatial competition in option demand markets which are prevalent in the health care sector[1]: Medical providers sell their products through health insurance to consumers who know their exact geographic location (address) and the distribution of their possible medical needs. The exact medical need of each consumer reveals only after getting sick, but before utilizing any medical product.[2] Under proper market positioning, the uncertainty regarding future medical needs generates option demand for multiple providers, although eventually each sick consumer attends only one of them.

Previous studies established the Max–Min differentiation principle for the corresponding spot market, where maximal differentiation presents on the dominant dimension[3]; See Tabuchi (1994), Veendorp and Majeed (1995), Ansari et al. (1998) and Irmen and Thisse (1998). I show here that competition in option demand markets yields different product and location choices, and consider their welfare implications.

I study the simplest possible option demand market: each provider sets option price for utilizing its medical product upon the emergence of medical need, and then consumers choose which option to buy—possibly both. The option price is equivalent to full insurance premium. This modeling approach reveals the

E-mail address: gms0014@auburn.edu.

[1] See Capps et al. (2003) for a detailed introduction to option demand markets.

[2] Hence, medical products here have no "experience-good" properties—see Bester (1998), for example, for the effect of this type of uncertainty on market positioning.

[3] The dominant dimension is the one with higher spatial cost parameter.

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principle nature and outcomes of providers' competition in a perfect option demand market, which is not interfered by insurers' intermediation. The important implications of more realistic and elaborated insurance markets to the present analysis are left for future research.

I show that two types of equilibria can endogenously emerge in this option market. In the first equilibrium providers choose to locate at the two ends of the city and at the middle of the products line. As both providers offer identical medical products, each consumer buys access only to the geographically nearest provider. In the second equilibrium providers cluster on the geographic dimension and locate on the first and third quartiles of the products line, and all consumers buy access to both providers. In Sorek (2016) I obtained similar product choices while abstracting the geographical dimension, which is equivalent to assuming the geographic clustering that emerges here as an equilibrium outcome.[4]

The single-purchase equilibrium here corresponds the Max–Min principle obtained for spot markets: providers are competing over the marginal consumers just like in spot markets, but on the option market the geographic dimension is always dominant because consumers have no ex-ante preference for specific product.

However, the multiple-purchases equilibrium is unique to option demand markets: due to providers positioning in the market, and corresponding prices, products that are substitutes ex-post (i.e. being exclusively utilized), are perceived as complements, ex-ante, and being jointly purchased.

Here, providers are not competing over the marginal consumer anymore, but rather each one of them tries to increase consumers' multiple-purchases by getting geographically closer to her rival, and to maximize the option value of her product, in a way that coincides with maximizing the joint option value of both products, due to the complementarity.

The welfare analysis shows that the option demand market may be efficient, but may also provide excessive or insufficient consumer-choice, in terms of product differentiation and geographic dispersion, depending on the spatial costs parameters. However, efficiency can be restored by regulating providers' geographic locations.

2. Model

I study the framework employed by Ansari et al. (1998) and Irmen and Thisse (1998) for spot market analysis. Consumers of unit mass, indexed i, are uniformly distributed over a linear city of a unit length. When buying insurance each consumer knows her geographic address $z_i \in [0, 1]$, and faces the probability π of becoming sick with medical need x_i. All possible medical needs are independently and uniformly distributed over the unit interval $x \sim U[0, 1]$. The distribution x is common knowledge and is independent of the address distribution z. Each sick consumer draws one medical need from the distribution x, which is then correctly diagnosed at no cost and becomes common knowledge. The above assumptions imply that sick consumers are uniformly distributed over a 1×1 square.

There are two medical providers, denoted $j = (1, 2)$. Each provider is defined by its geographic location, w_j, and its clinical specialization area y_j, which is a point on the medical-conditions line. When healthy, consumer utility is v, and when sick utility drops to zero if not treated. Medical treatment restores the initial utility subject to the spatial costs:

$$u = v - m(x_i - y_j)^2 - c(z_i - w_j)^2$$

where $m, c > 0$ are the mismatch cost and commuting cost parameters, respectively. For the healthy consumer, expected utility from buying insurance from provider j only is

$$E(u_i) = (1-\pi)v + \pi\left[v - m\int_0^1 (x - y_j)^2 dx - c(z_i - w_j)^2\right] - p_j \quad (1)$$

where p_j is the option price set by provider j, i.e. the full-insurance premium, paid up front. Finally, I assume zero marginal cost of provision, and that v is sufficiently large, so all product utilizations are beneficial to consumers. The analysis follows a three stage time line:

(1) First, both providers choose geographic location w_j and product specialization y_j.
(2) Then, providers set option prices and consumers make their insurance purchase decisions.
(3) Lastly, medical needs are realized and consumers are treated by their preferred provider under insurance coverage.

3. Equilibrium

3.1. Single-access purchases

Without loss of generality, I assume $w_1 \leq w_2$ and $y_1 \leq y_2$. Under single-access equilibrium providers compete over the marginal consumers just like in spot price competition. The following condition defines the demand faced by provider 1, by comparing the expected utility from buying insurance from each provider

$$\pi\left[v - n\int_0^1 m(x - y_1)^2 dx - c(z_i - w_1)^2\right] - p_1 \geq \pi\left[v - n\int_0^1 m(x - y_2)^2 dx - c(z_i - w_2)^2\right] - p_2. \quad (2)$$

Imposing equality in (2) yields the marginal consumer who buys insurance from provider 1, denoted $\tilde{z}$:

$$\tilde{z} = \frac{1}{2}\left\{\frac{m\left[\left(y_2^2 - y_1^1\right) - (y_2 - y_1)\right] + \frac{p_2 - p_1}{\pi}}{c(w_2 - w_1)} + (w_2 + w_1)\right\}. \quad (2a)$$

Hence the surplus for provider 1, PS_1, is given by

$$PS_1 = \frac{1}{2}\left\{\frac{m\left[\left(y_2^2 - y_1^1\right) - (y_2 - y_1)\right] + \frac{p_2 - p_1}{\pi}}{c(w_2 - w_1)} + (w_2 + w_1)\right\} p_1. \quad (3)$$

Maximizing (3) for p_1 yields the optimal option price[5]

$$p_1^* = \frac{\pi m\left[\left(y_2^2 - y_1^2\right) - (y_2 - y_1)\right] + p_2 + \pi c\left(w_2^2 - w_1^2\right)}{2}. \quad (4)$$

The corresponding optimal option price for provider 2 is

$$p_2^* = \pi c(w_2 - w_1) - \frac{\pi m\left[\left(y_2^2 - y_1^2\right) - (y_2 - y_1)\right] - p_1 + \pi c\left(w_2^2 - w_1^2\right)}{2}. \quad (4a)$$

[4] In that work I summarize the current literature on competition between medical providers under insurance sales.

[5] The asterisk superscript denotes optimization outcomes.