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Location and Product Choice in Option Demand Markets

Gilad Sorek

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Gilad Sorek*

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Abstract

Consumers' uncertainty regarding their future needs generates demand for options to utilize different products. Such options are commonly sold in the form of insurance. A prime example for option demand presents in health care markets and other repair markets. This work studies two-dimensional spatial competition between medical providers who choose their geographical location and medical-care specialization (i.e. product differentiation). Consumers know their geographical address but do not know their preferred medical treatment before getting sick. Providers make location and product choices and then compete by selling options to utilize their services (i.e. health insurance). I characterize two types of equilibria: one with Min-Min differentiation that is complete assimilation and the other with Min-Intermediate differentiation, in which both providers locate at the city center and product differentiation is efficient. In the first equilibrium each consumer buys insurance for one provider only and in the second all consumers are buying insurance for both providers. I further show that under regulated locations product differentiation first increases with regulated geographic distance and then it decreases. For intermediate regulated distance consumers who reside around the city center buy insurance for both providers and those at the city ends buy insurance only for the nearby provider.

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*Economics Department - Auburn University , Auburn AL. Email: gms0014@auburn.edu . Tel: 716-867-9497.

1 Introduction

I study duopolistic spatial competition in two dimensions, with consumers who know their exact location in one dimension only, and their location on the other dimension is a random draw from a common distribution. Such uncertainty generates option-demand that is a willingness to pay in advance for the option to utilize a product when needed. A prime example for such demand presents in health care markets: consumers know their geographic address and proximity to each medical providers (e.g. hospitals), but their exact medical needs are random and unspecified before getting sick. In the context of health care markets option sales take the form of health insurance.

In what follows I will adopt the health-care market example[1], to show how location and product choices in option demand markets differ from those taken under spot market sales. That is because consumers perceive alternative treatments differently before and after getting sick: on the spot market, consumers' preferences for medical product are defined by their specific medical need. Hence, each consumer chooses utilizing one medical product - the most cost effective one.

However, before getting sick consumers' know only the distribution of all possible medical needs. Consequently consumers may choose buying options to utilize both medical products. That is to have both under insurance coverage. Hence, medical providers that are perceived as substitutes on the spot market (after getting sick) may be perceived as complements on the option market (before medical need emerged). Moreover, if all consumers face a common (or similar) distribution of possible medical needs, taste differentiation on the option market is lower than in the spot market. In case that all consumers draw their medical needs from a common distribution, they are ex-ante identical with respect to the expected preferred medical product. Thus, their preferences for medical providers are based only on geographic proximity.

The first papers to study multi-dimensional spatial competition established the Max-Min principle: sellers choose to maximally differentiate along one dimension and minimally differentiate over all other dimensions; see Tabuchi (1994) Veendorp and Majeed (1995), Ansari et al. (1998) and Irmen and Thisse (1998). Elizalde (2013) provides empirical support for the Max-Min differentiation hypothesis using data on geographic location and product differentiation from Spanish cinema industry[2]. In all these papers however consumers know their exact locations in all dimensions and thus price competition takes place on the spot market.

I find that two-dimensional competition in option demand markets yields two alternative equilibria. The first equilibrium is of complete assimilation - that is Min-Min differentiation: both providers locate in the middles of the city and the products lines. Hence they are engaged in a fierce Bertrand competition that brings prices down to marginal cost. This result is in line with Bester's (1998) who showed that consumers' uncertainty regarding the quality of the product, i.e. differentiation along the vertical dimension, mitigates horizontal differentiation[3].

[1] The formal analysis here applies to other repair markets, e.g. car-repair services sold under car-insurance policies. See Capps et al. (2003) for more examples on option demand markets.

[2] The observed product choice in this study is the set of movies exhibited in each cinema theatre.

[3] In Rhee et al. (1992) providers cannot observe consumers' valuation for one of two product characteristics, and they choose location only in the observed dimension. In the present work consumers face uncertainty regarding their

In this Min-Min differentiation equilibrium each provider is selling to half of consumers and no one buys options from both providers (as they are identical in both dimensions). Hence, I refer to this case as equilibrium with exclusive-sales, which due to consumers' preferences without any exclusivity restriction imposed by providers.

The second equilibrium I characterize is of non-exclusive sales with all consumers buying options from both providers. In this equilibrium both providers are still located in the middle of the city, and are *efficiently* differentiated on the products line. This result generalizes the efficient product differentiation under option sales I explored in an earlier work, for unidimensional spatial competition (see Sorek, 2015). Elizalde (2013) shows that the same location and differentiation choice would be taken by a monopolist that owns two selling points on the spot market, naming this market outcome Min-Intermediate differentiation. In his work however consumers do not buy from both stores (i.e. there are only exclusive sales)[4].

I then turn to explore the implications of regulating providers' locations. I find that the regulated geographic distance between providers has non-monotonic effect on product differentiation choices. First product differentiation is increasing with regulated distance - beyond the efficient level, but then its starts decreasing back to the efficient level. Under larger regulated distance providers locate at the middle of the products line. In the range of increasing product differentiation all consumers are buying options from both sellers. In the range of decreasing product differentiation only part of consumers - who reside around the middle of the city - are buying option form both sellers, and those who live closer to the city ends by option only for from the nearby provider.

The remainder of the paper develops as follows: Section 2 presents the detailed market model. Section 3 analyzes equilibrium with exclusive and non-exclusive sales. Section 4 studies market equilibrium under regulated locations, and Section 5 concludes this work.

2 The Model

I am studying a two-dimensional spatial competition like in Tabuchi (1994) Veendorp and Majeed (1995). The two dimensions are interpreted as geographic address and location on the products line. A unit mass of consumers, indexed i, is uniformly distributed over a linear city of unit length. Each consumer knows her geographic address $x_i \in [0, 1]$.

Each consumer faces the probability π to become sick with a medical need z_i. All medical needs are uniformly distributed over the unit interval $z \sim U[0, 1]$. The distribution z is a common knowledge and is independent of the address distribution x. However, the exact medical need of each consumer is revealed only once getting sick. Each sick consumer draws one medical need from the distribution z, which is correctly diagnosed at no cost and then becomes a common knowledge. The above assumptions imply that sick consumers are uniformly distributed over a unit square.

own ideal characteristic in one dimension, and producers choose location in both dimensions.

[4]Bonanno (1987) showed that such a multi-stores monopolist provides efficient differentiation in unidimensional spot market. Anderson and Neven (1989) showed that when consumers are mixing the products sold by two independent providers, non-cooperative unidimensional differentiation choices are efficient.

There are two medical care providers denoted $j = (1, 2)$. Each provider is defined by its geographical location (address) y_j and its location in the medical product space, denoted w_j, which may also resemble its relative clinical specialization area. When healthy, consumer utility is v, and when sick it drops to zero if not treated.

Once treated, consumer's utility depends on the effectiveness of the medical product utilized the price paid and the traveling cost to the medical provider. The effectiveness of a medical product is decreasing with horizontal distance from the treated medical need. Hence the utility of the sick consumer i from utilizing medical product sold by provider j is

$$u = v - \theta\left(x_i - y_j\right)^2 - t\left(z_i - w_j\right)^2 - p_j \tag{1}$$

The parameter θ measures the degree of differentiation over medical conditions, or the cost of mismatch between medical needs and treatments. Similarly the parameter t measures transportation cost in the geographical dimension. This formulation was employed by Tabuchi (1994) and Ansari et al. (1998). For the healthy consumer, expected utility from using medical product y_j to treat all alternative medical needs for the option price op_j is

$$E(u) = (1-\pi)v + \left[\pi \int_0^1 \left[v - \theta\left(x - y_j\right)^2\right] dx - t\left(z_i - w_j\right)^2\right] - op_j \tag{2}$$

This formulation of the utility function is conventional to the literature that studied spatial competition in health care and health insurance markets[5]. It implies neutrality with respect to the financial risk associated with medical expenses. Abstracting from risk aversion greatly simplifies the analysis. More importantly however, it allows focusing on the effects of option sales on market outcomes that are solely due to its non-linear dynamic structure[6]. Adding risk-aversion should not alter our main results.

I assume zero marginal cost of provision, and $\frac{4V}{5\theta} > 1$[7]. To simplify exposition I will describe provider's pricing considerations in terms of the insurance premiums - i.e. the option price *op*. This is equivalent to selling insurance (with full reimbursement) through perfectly competitive insurers, who offer separated policies for covering the service of each provider, letting consumers decide which policy to buy (possibly both).

[5] See for example Gal-Or (1997), Lyon (1999) and Katz (2011), who have focused on the strategic interaction between insurers and providers that are differentiated along one dimension only, assuming maximal differentiation (that is abstracting from differentiation choices).

[6] That is an upfront payment that gives the option to utilize a product at zero spot price, which corresponds to insurance premiums (with full reimbursement).

[7] To assure that all product utilizations are beneficial to consumers (at zero price) and thus socially desired.

3 Equilibrium

I confine attention to symmetric equilibria with $w_1 \leq w_2$ and $y_1 \leq y_2$. The game follows a three stage time line: at the first stage providers choose locations and specialization. At the second stage providers set option prices for their products, and healthy consumer choose which insurance policy to buy. In the third stage medical conditions are being realized and consumers pick their which medical services to utilize.

3.1 Exclusive Sales

I start by studying equilibrium with exclusive sales, that is each consumer chooses to buy an option to utilize the services of one provider only[8]. Under exclusive sales the two providers are competing over the marginal consumers, just like in spot price competition. The following condition defines the option demand faced by provider 1, put by all consumers who prefer buying option to utilize product 1 over an option to utilize product 2

$$\pi \left\{ \begin{array}{c} \int\limits_0^1 \left[V - \theta\left(x - y_1\right)^2 \right] dx - \\ -t\left(z_i - w_1\right)^2 \end{array} \right\} - op_1 \geq \pi \left\{ \begin{array}{c} \int\limits_0^1 \left[V - \theta\left(x - y_2\right)^2 \right] dx - \\ -t\left(z_i - w_2\right)^2 \end{array} \right\} - op_2 \tag{3}$$

Condition (3) simply compares the expected utility from buying each option considering all possible medical conditions (and corresponding mismatch costs) and commuting cost to each provider. For the marginal (indifferent) consumer, denotes $\widetilde{z}$, condition (3) holds and can be written as

$$\widetilde{z} = \frac{1}{2} \left\{ \frac{\theta\left[\left(y_1 - y_2\right) + \left(y_2^2 - y_1^2\right)\right] + \frac{\left(op_2 - op_1\right)}{\pi}}{\left(w_2 - w_1\right)t} + \left(w_2 + w_1\right) \right\} \tag{3a}$$

Hence the surplus of provider 1 is given by

$$PS_1 = \frac{1}{2} \left\{ \frac{\theta\left[\left(y_1 - y_2\right) + \left(y_2^2 - y_1^2\right)\right] + \frac{\left(op_2 - op_1\right)}{\pi}}{\left(w_2 - w_1\right)t} + \left(w_2 + w_1\right) \right\} op_1 \tag{4}$$

Maximizing (4) with respect to op_1 yields the optimal option

$$op_1^* = \frac{\pi\theta\left[\left(y_2^2 - y_1^2\right) - \left(y_2 - y_1\right)\right] + op_2 + \pi t\left(w_2^2 - w_1^2\right)}{2} \tag{5}$$

Plugging (5) back into (4) I rewrite the surplus:

$$PS_1 = \frac{\pi}{8t\left(w_2 - w_1\right)} \left[\theta\left[\left(y_2^2 - y_1^2\right) - \left(y_2 - y_1\right)\right] + \frac{op_2}{\pi} + t\left(w_2^2 - w_1^2\right) \right]^2 \tag{6}$$

[8] Providers do not set any restriction for exclusive purchases to prevent consumers from buying option to utilize both services.

Differentiating (6) for y_1 yields the first order condition for optimal product choice by provider 1: $y_1^* = \frac{1}{2}$. Note that y_1^* is independent of all the parameters and the endogenous variables, hence it will be chosen by provider 2 as well, regardless of the timing of location and differentiation choices. Plugging $y_1^* = \frac{1}{2}$ back into (6) and differentiating for w_1 yields the first order condition for optimal location choice

$$w_1^* 4 \left(w_2 - w_1^*\right) - \left(w_2^2 - \left(w_1^*\right)^2\right) = \frac{1}{t} \left\{ \frac{op_2}{\pi} \right\} \tag{7}$$

Applying symmetry to (5) and plugging back into (7) reveals that the only symmetric equilibrium is $w_1^* = w_2^* = \frac{1}{2}$. When the two providers are located at the middle no one would indeed like to buy from both of them because they offer identical products at equal cost. Hence the two producers equally share the market with exclusive sales. Proposition 1 summarizes the latter results.

Proposition 1 *There exists a equilibrium with exclusive sales and Min-Min differentiation:* $w_{1,2}^* = y_{1,2}^* = 0$.

Proof. Proof is in equations (3)-(7). ∎

The complete-assimilation equilibrium defined in proposition 1 is obviously inefficient in terms of minimizing expected traveling and mismatch costs. It also implies extreme competition between providers who fail to exploit potential market power through differentiation. Nonetheless, it can be shown that under the option pricing (5), for any location and differentiation choices that satisfy $(w_2 - w_1) \leq \frac{\theta}{t4}(y_2 - y_1)$, there is a range of consumers around the middle who would prefer buying option from both providers. Then however providers are not competing over the marginal consumers defined in (3a) anymore, and are engaged in non-exclusive sales. The nature and outcomes of the competition under non-exclusive sales are explored in the next subsections.

3.2 Non-exclusive sales

Here I explore equilibrium under which at least some consumers buy options from both providers, still confining attention to symmetric market outcomes. Consumer who buys options from both providers will choose which provider to attend after getting sick, in light of the exact realized medical need. In particular consumers who bought options from both providers will choose utilizing the service of provider 1 only if this minimizes the sum of mismatch and commuting cost

$$\theta \left(x_i - y_1\right)^2 + t \left(z_i - w_1\right)^2 \leq \theta \left(x_i - y_2\right)^2 + t \left(z_i - w_2\right)^2 \tag{8}$$

Simplifying (8) I obtain the range of medical conditions $(0, \widetilde{x}_i)$ for which the consumer who resides at z_i will choose utilizing the service of provider 1

$$\widetilde{x}_i \leq \frac{\frac{t}{\theta}\left[w_2^2 - w_1^2 - 2z_i\left(w_2 - w_1\right)\right] + \left(y_2^2 - y_1^2\right)}{2\left(y_2 - y_1\right)} \tag{8a}$$

I then use (8a) to define the indifference condition for the marginal consumer who weakly prefers buying options from both providers over buying an option only from provider 2

$$\pi\left[\begin{array}{c}\int_0^1\left[V-\theta\left(x-y_2\right)^2\right]dx- \\ -t\left(z_i-w_2\right)^2\end{array}\right]-op_2\leq\pi\left\{\begin{array}{c}\int_0^{\widetilde{x}}\left[V-\theta\left(x-y_1\right)^2\right]dx+ \\ +\int_{\widetilde{x}}^1\left[V-\theta\left(y_2-x\right)^2\right]dx- \\ -\left(1-\widetilde{x}\right)t\left(w_2-z_i\right)^2-\widetilde{x}t\left(z_i-w_1\right)^2\end{array}\right\}-op_1-op_2 \tag{9}$$

Condition (9) is similar to (3). It compares expected utility from buying an option form provider 2 only (on the left), with the expected utility from buying options to utilize both services, accounting for the propensity to utilize each one of them - as defined in (8a). Elaborating (9) yields the following condition

$$op_1\leq\pi\widetilde{x}^2\theta\left(y_2-y_1\right) \tag{10}$$

Condition (10) defines the upper bound of the option price op_1 which makes the purchase of both options preferred of buying option 2 only. This upper bound on op_1 depends positively on the propensity to utilize the service of provider 1. This propensity however is decreasing with the distance between consumer address and the location of provider 2. Hence (10) will hold with weak inequality for the marginal consumer who buys both options, denoted $\widetilde{z}>\frac{1}{2}$, where all consumer with $z_i\in(\widetilde{z},1)$ are buying one option - from provider 2 only. A similar condition defines the marginal consumer who is indifferent between buying options from both providers and buying one option - from provider 1 only. Under symmetric equilibrium this consumer is located at $(1-\widetilde{z})<\frac{1}{2}$.

Substituting (8a) into (10) I write the surplus of provider 1 as a function of the marginal consumer who chooses buying the option to use her services

$$PS=op_1\cdot\widetilde{z}=\frac{\pi\theta\left[\frac{t}{\theta}\left[w_2^2-w_1^2-2\widetilde{z}\left(w_2-w_1\right)\right]+\left(y_2^2-y_1^2\right)\right]^2}{4\left(y_2-y_1\right)}\widetilde{z} \tag{11}$$

Maximizing (11) with respect to $\widetilde{z}$ yields the marginal consumer who is targeted by provider 1, given location and product choices

$$\widetilde{z}_i^*=\frac{\frac{t}{\theta}\left[w_2^2-w_1^2\right]+\left(y_2^2-y_1^2\right)}{\frac{t}{\theta}\left(w_2-w_1\right)6} \tag{12}$$

Plugging (12) into (10) reveals the corresponding optimal option

$$op_1^*=\frac{\pi\theta4\left[\frac{t}{\theta}\left(w_2^2-w_1^2\right)+\left(y_2^2-y_1^2\right)\right]^2}{9\left(y_2-y_1\right)} \tag{13}$$

Then, substituting (12) and (13) into (11) I rewrite the surplus as a function of location and product choices

$$PS_1^* = \frac{\pi\theta 2\left[\frac{t}{\theta}\left(w_2^2 - w_1^2\right) + \left(y_2^2 - y_1^2\right)\right]^3}{27\left(y_2 - y_1\right)\frac{t}{\theta}\left(w_2 - w_1\right)} \tag{14}$$

Differentiating (14) with respect to y_1 and w_1 I obtain the first order conditions for provider 1's optimal location and product choices

$$6\left(y_2 - y_1^*\right)y_1^* = \frac{t}{\theta}\left(w_2^2 - w_1^2\right) + \left(y_2^2 - \left(y_1^*\right)^2\right) \tag{15}$$

$$6\left(w_2 - w_1^*\right)w_1^* = \left(w_2^2 - \left(w_1^*\right)^2\right) + \frac{\theta}{t}\left(y_2^2 - y_1^2\right) \tag{16}$$

Lemma 1 *There is no equilibrium with interior solution to satisfy conditions (15)-(16)*

Proof. Comparing (12) and (16) reveals that w_1^* coincides with w^*. However by definition, under non-exclusive sales $w^* > \frac{1}{2}$, and by the assumed symmetry $w_1^* < \frac{1}{2}$. That is a contradiction. ■

Lemma 1 implies that optimal location is approaching the city center. Then however, by (11), under symmetric equilibrium $w^* > 1$. This makes conditions (15)-(16) for interior choices redundant. Hence I turn now to analyze an equilibrium with $w_i^* = 1$, under which all consumers buy both options. For $w_i^* = 1$ the surplus function (11) becomes

$$PS_1 = \frac{\pi\theta\left[\frac{t}{\theta}\left[w_2^2 - w_1^2 - 2\left(w_2 - w_1\right)\right] + \left(y_2^2 - y_1^2\right)\right]^2}{4\left(y_2 - y_1\right)} \tag{17}$$

Maximizing (17) for w_1 yields $1 - w_1^* > 0$, implying a corner solution with $w_1 = \frac{1}{2}$. Then the surplus expression becomes: $PS_1 = \frac{\pi\theta(y_2+y_1)^2(y_2-y_1)}{4}$. Maximizing the latter for y_1 and imposing symmetry yields

$$3y_1^* = y_2 \Rightarrow y_1^* = \frac{1}{4} \tag{18}$$

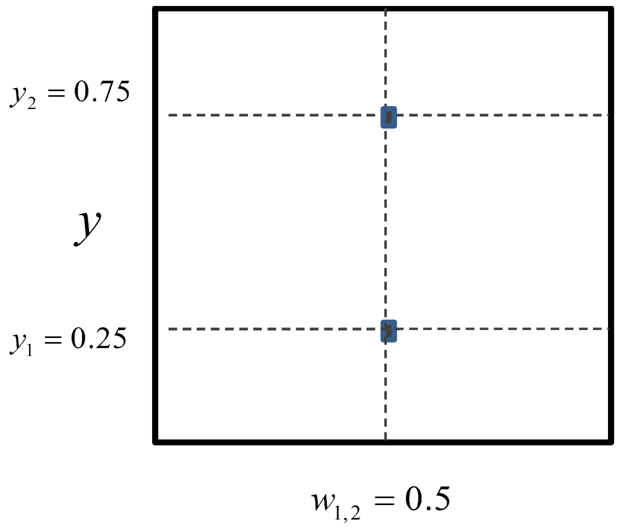
Proposition 2 *There is an equilibrium with non-exclusive sales and Min-Intermediate differentiation that is:* $w_1 = w_2 = \frac{1}{2}$ *and* $y_1^* = \frac{1}{4}, y_2^* = \frac{3}{4}$.

Proof. Proof is provided above. ■

Plugging the equilibrium locations and product choices in (8a) for $z = 1$ and then in (10), yield the equilibrium prices $op_{1,2} = \frac{\pi\theta}{8}$.[9] Figure 1 shows equilibrium locations with non-exclusive sales.

[9] In Sorek (2015) I obtain the same equilibrium prices under efficient product differentiation for unidimensional spatial competition in option demand markets.

Figure 1: Location and product choices with non-exclusive sales



4 Regulated locations

Suppose now that locations are symmetrically regulated and denote the regulated distance between hospitals as $\triangle\overline{w}$.

Proposition 3 $\forall\triangle\overline{w} \in (0,1)$ *there exists an equilibrium with exclusive sales and* $y_1^* = y_2^* = 0$.

Proof. By (6) optimal product choice is $y_1^*, y_2^* = \frac{1}{2}$ independent of locations. Under complete product assimilation no one buys two options hence there only exclusive sales. ■

In case of non-exclusive sales condition (15) still applies with respect to optimal product choices

$$6\left(y_2 - y_1^*\right) y_1^* - \left(y_2^2 - \left(y_1^*\right)^2\right) = \frac{t}{\theta}\triangle\overline{w} \tag{19}$$

Under symmetric equilibrium condition (19) becomes $\left(1 - 2y_1^*\right)\left(6y_1^* - 1\right) = \frac{t}{\theta}\left(\triangle w\right)$. The left side of (19) is a quadratic function that yields non-negative values for $\frac{1}{6} \leq y_1^* \leq \frac{1}{2}$. However the optimality condition (19) is valid (as an interior solution) only if $\frac{1}{2} < z^* < 1$. By (12) this requirement implies that

$$\frac{1}{2} < \frac{\frac{t}{\theta}\triangle\overline{w} + \left(y_2^2 - y_1^2\right)}{\frac{t}{\theta}\triangle\overline{w}6} < 1 \Rightarrow \frac{1}{5} < y_1^* < \frac{1}{4}, 0.12 < \frac{t}{\theta}\triangle\overline{w} < 0.25 \tag{20}$$

A lower regulated distance (i.e. $\frac{t}{\theta}\triangle\overline{w} \leq 0.12$) implies $z^* \geq 1$ and thus provider 1 maximizes the following modified version of the surplus expression in (17)

$$PS_1 = \frac{\pi\theta\left[\left(y_2^2 - y_1^2\right) - \frac{t}{\theta}\triangle\overline{w}\right]^2}{4\left(y_2 - y_1\right)} \tag{21}$$

Imposing symmetry on the first order condition for maximizing (21) I obtain

$$\left(1 - 2y_1^*\right)\left(1 - 4y_1^*\right) = \frac{t}{\theta}\triangle\overline{w} \tag{22}$$

The left size of (21) is a quadratic function which yields non-negative values for $y_1^* \leq \frac{1}{4}$. For $\triangle\overline{w} = 0$ (22) implies $y_1^* = \frac{1}{4}$ and $\triangle y^* = \frac{1}{2}$ as in proposition 2. for $0 < \frac{t}{\theta}\triangle\overline{w} \leq 0.12$ condition (22) implies that y_1^* decreasing (thus $\triangle y^*$ is increasing) with $\triangle\overline{w}$, up to $\triangle y^* = \frac{3}{5}$. Proposition 3 summarizes the latter results.

Proposition 4 *(a)*$\forall\frac{t}{\theta}\triangle\overline{w} \in (0, 0.12)$ *there exists an equilibrium with non-exclusive sales, and unique corresponding product differentiation* $\triangle y^* \in \left(\frac{1}{2}, \frac{3}{5}\right)$*, (b)* $\forall\frac{t}{\theta}\triangle\overline{w} \in (0.12, 0.25)$ *there exists an equilibrium with mixed exclusive and non-exclusive sales, and corresponding product differentiation* $\triangle y^* \in \left(\frac{1}{2}, \frac{3}{5}\right)$*.*

Proof. Proof is in equations (18)-(21). ■

Figure 2: Product differentiation under regulated locations

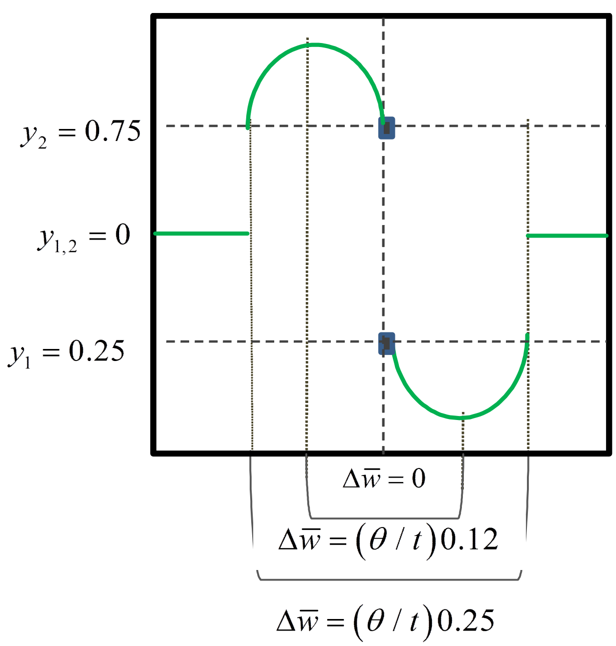


Figure 2 shows the possible equilibria under regulated prices. When the regulated distance is zero, product differentiation is efficient and the equilibrium coincides with the presented in Proposition 2.

Then as the regulated distance increases product differentiation first increases, along the green curves, up to $\frac{t}{\theta}\triangle\overline{w} = 0.12$. Then, further increase in the regulated distance decreases product differentiation, which gets back to the efficient degree for $\frac{t}{\theta}\triangle\overline{w} = 0.25$. For higher regulated distance product differentiation falls down to zero. Hence if $t = \theta$ both expected mismatch cost and expected transportation cost and also thus their sum can be minimized.

5 Conclusions

Consumers' uncertainty regarding their exact future needs generates option demand, which widely presents in health-care and other repair markets. This work shows that competition in option demand markets results in distinctive location and product choices. This is because of lower (ex-ante) taste differentiation on the option market, and because products that are considered as substitutes on the spot market - after exact needs are realized, can be perceived as (ex-ante) complements on the option markets.

I have characterized an equilibrium of Min-Min differentiation where each consumer buys option from one provider only, and alternative equilibrium with Min-Intermediate differentiation under which all consumers buy options from both providers. Hence this work modifies the results obtain in previous work on two-dimensional spatial competition in spot prices which yield Max-Min principle.

It also generalizes my earlier analysis of unidimensional spatial competition in option demand market (Sorek, 2015). There I study only product choice with consumers that are ex-ante identical, and show that in equilibrium providers choose intermediate differentiation with both selling options to all consumers. In the present work both providers choose to locate in the city center, making consumers' geographic location irrelevant to their option purchase choices. Given that, intermediate product differentiation is consistent with the one I obtained abstracting the geographical dimension.

The analysis of product choices under regulated prices yielded non-monotonic effect geographic distance on product differentiation. The efficient product differentiation can be achieved under zero and positive regulated distance. Under zero distance all consumers buy option (access), as the distance increases consumers who reside off the city center drop the remote provider our of insurance coverage. When the regulated distance is increasing enough, providers choose to perfect assimilation on the product line, implying there are only exclusive sales. Efficiency in both spatial product dimension can be achieved only if mismatch and transportation cost parameters are equal. Yet, regulating a minimal geographic distance can in general reduce the sum of expected transportation and mismatch cost, thereby improving welfare.

In the context of health care markets, future study is called to elaborate a more realistic structure of the insurance market. Such insurance market would compose dominant insurers that act as intermediaries: negotiating with providers over prices and forming providers' networks for the insured. Previous studies that focused on this strategic interaction between insurers and providers considered differentiation in one dimension only, and abstracted from differentiation choice assuming maximal differentiation (Gal-Or, 1997, Lyon 1999, and Katz 2011).

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