

# SPATIAL-COMPETITION, INTEGRATED FRAMEWORK OF CENTRAL-PLACE SYSTEM WITH AGGLOMERATION ECONOMIES

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***Abstract** - It is argued that the trade-off interaction between agglomeration economies and transportation costs cannot be excluded from the analysis of the central-place system. First, an overlapping-area model between two competitors of market areas is examined both cases in homogeneous and differentiated products together with the relevant formation of supply areas. The analysis then further explores an exclusive-area model in the duopoly and oligopoly conditions of market areas and the formation process of supply areas. Finally, consideration is given to the methodological connectivity between central-place system and agglomeration economies.*

**Key-words** : FIRM LOCATION, AGGLOMERATION ECONOMIES, TRANSPORTATION COSTS, CENTRAL PLACE SYSTEM

**JEL Classification** : R12, R30

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## 1. INTRODUCTION

The concern of the paper is to clarify the structural relevance between market areas and supply areas through the investigation of firm location under the given conditions of market demand, deposit of inputs, technologies for production and spatial competition in both types of area. This can be referred to the input-output framework and there is certain established framework in location analysis. Koopmans and Beckmann (1957) initially combined supply nodes with demand nodes by means of linear programming model between two distant locations and solve the problem of profit maximization condition of a producer by minimizing costs of transportation. However, this approach insufficiently includes the notion of spatially constrained economic factors. These economic factors have been well considered on the field of new economic geography. The interaction between vertical specialization and trade is examined by Hummels et al., (1995), applying input-output tables to sequential linkages of intermediate goods together with empirical studies.

In terms of agglomeration economies and trade, Parr et al., (2002) investigate the regional economies in the U.S. Midwest with the notion of hollowing out, and the structural change in firms and establishments caused from the reduction of transportation and transaction costs. For the recent spatial linear-programming approach, Jones and Kierzkowski (2005) explore the methodological connectivity between input and output, including the notions of vertical integration, increase in scale and fragmentation of production. Moreover, Silva and Hewings (2007) examine the multi-located firms and separation of location by the inclusion of communication cost and firm contracts in the principal-agent theory.

These studies can be further detailed in spatial framework by the application of central-place system. However, established central-place theory has been independently investigated the framework of input and output as supply-area and market-area systems, which has little attention to the integrated input-output framework. While the integrated framework of both types of area would be treated as an extended version of the duality theory, this input-output framework would not be complete unless the analysis took additional spatial factors into consideration. These factors are suggested to be parts of spatially unconstrained and constrained internal and external economies. The spatially constrained types of economies are called agglomeration economies and these, together with spatially unconstrained types of economies, constitute the neglected factors in existing central-place theory. As agglomeration economies have a trade-off interaction with transportation costs, an analysis of transportation system and network is also required to include in the model. The relationship between transportation networks and market-area boundaries should be referred to Beckmann (1968 : 83-85) and this can also be applied to

the framework of supply-area transportation network. This paper will clarify the importance of these neglected factors to be included in the integrated framework of market-area and supply-area systems. This alternative approach not only demonstrates the effects of market area change on the spatial structure of supply area but also investigates the incentives governing the determination of the firm location.

The analysis of market areas were systematically examined by Lösch (1954) in terms of spatial competition, with demand conditions, technology and factor prices given. By contrast, supply areas were initially explored by Lösch (1938) with respect to spatial competition of inputs with the given structures of assembly cost, technology and the demand conditions of output. However, there exists a problem that neither market-area analysis nor supply-area analysis has dealt with the location of production. From the standpoint of a producer, every plant has supply areas to obtain inputs from suppliers, and market areas to distribute output. This implies that both types of area should be investigated within a single framework. Treatment of an integrated methodology will be prefaced by a consideration of the input-output framework which is referred to conventional economic analysis as duality theory. According to Shepard (1953), this theory states that the unknown cost function is derived from the given production function and structure of factor cost, and that the unknown production function is derived from the given cost function and structure of factor cost. From these relations, the duality theory can also be stated in terms of an input-output framework: The unknown cost function is derived from the given structure of factor cost and production function. By contrast, the unknown structure of factor cost is derived from the given cost and production functions. Applying this notion, the market-area system and supply-area system are connected by means of spatial production function. In this paper, the integrated central-place approach will be applied to four hypotheses of spatial competition and will be observed by the effects of various economic forces on the decision-making of the firm location. In addition, it is clarified that agglomeration economies have a crucial role in the existing framework of market-area and supply-area systems through the analysis of cooperative and competing relationships between producers in an economic plain.

## **2. AGGLOMERATION ECONOMIES AND FIRM LOCATION**

As introduced in the previous section, the notions of agglomeration economies are essential factors for the analysis of firm location and spatial organization. These economies have criteria of scale, scope and complexity dimensions, together with two dimensions that are internal and external to the firm. In terms of internal aspect to the firm, first, economies of scale (horizontal integration) indicate that there is an availability of cost saving as the production scale increases, where average production cost forms a shape of

decreasing returns to scale. Second, economies of scope (lateral integration) are observed when varieties of production achieve more efficient and less cost operation than with the single processing of products. This can be interpreted as an utilization of fixed-cost element by means of maximizing usage of residual production facilities. Finally, economies of complexity (vertical integration) represent the opportunity of cost saving by integrating multiple processing stages on the upstream and downstream linkages of a firm. If these three types of economies require spatial proximity, these are referred to spatially constrained internal economies.

With respect to external economies, the criterion of scale is referred to as localization economies. These economies are observed when there are possibilities for firms to obtain labor cost savings, joint action for input extraction and specialized services. The criterion of scope is relevant with urbanization economies, which are generally located in metropolitan areas as a result of the various cost saving benefits to be had in such areas. As advantageous factors, administrative accessibility, well-organized infrastructure, variety of labor supply, a highly advanced system of transportation and communication can be considered. These involve different and unrelated industries in a large urban area. However, disadvantageous factors such as the higher price of land, congestion and pollution also exist as urbanization diseconomies. The criterion of complexity is referred to activity-complex type of agglomeration economies, which relies on trade between different firms in a product chain. These economies can be seen at Silicon Valley in California and aero-space production complex in Los Angeles and Seattle. If these three criteria of economies do not require spatial proximity, these are referred to spatially unconstrained external economies in terms of scale, scope and complexity. As agglomeration economies exist under the certain condition of spatial proximity, these are generally involved in extra burden of transportation costs in terms of assembly and/or distribution shipping costs. As a result, producers are needed to consider the optimal firm location with the trade-off interaction between agglomeration economies and transportation costs.

In order to reveal the importance of agglomeration economies to be included in the analysis of firm location, the following four hypothetical scenarios will be introduced. First, in Case A, a perfectly overlapping market-area structure will be examined. It assumes two independent brands and that their market areas overlap perfectly. The centers of the market areas and supply areas are assumed to be identical, and inputs are shared by both firms. Secondly, Case B will explore one of the special cases where two brands share the same market area, while owning different centers of distribution. A notable point will be that though they are sharing the same plain, the market areas are not identical between the two firms with respect to the cost minimization

behaviour. Thirdly, in Case C, a pattern will be shown that each market area is exclusively dominated by one brand of product and that both types of area are identical. One possible reason for having these exclusive patterns is that there are gaps between available market-area sizes and the limited production scale of the firm. Finally, Case D will deal with oligopoly competition in Case C. It assumes that there are three independent brands and each market area supplies products exclusively from one of the three brands. The relevant supply area will be the same structure as its market area. The former two cases, Cases A and B, will be explored as an overlapping-area model and the latter two, Cases C and D, will be investigated as an exclusivity-area model.

### 3. A MULTIPLE-CENTER OVERLAPPING-AREA MODEL

#### 3.1. Perfectly Overlapping Duopoly Market Areas (Case A)

An overlapping spatial pattern of market areas under the condition of perfectly-overlapping duopoly market areas and the relevant structure of supply areas will be analyzed.

This case shows that there is no exclusivity in the market areas between the two product-differentiated brands *a* and *b*. As shown in figure 1, they share the same market area. This case will assume that two brands are distributed by different companies and that they are competing with another brand with respect to output level. It is also assumed that the two brands are similar products and that the two producers have the same technologies and other economic conditions. This spatial pattern shows that two independent firms are sharing common market areas.

*Figure 1. Perfectly overlapping duopoly market areas*

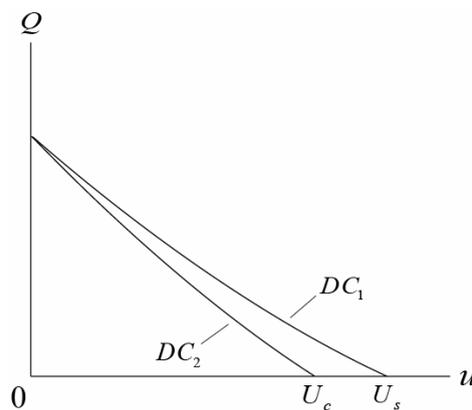
|               |               |
|---------------|---------------|
| $\alpha\beta$ | $\alpha\beta$ |
| $\alpha\beta$ | $\alpha\beta$ |

It seems possible to consider the application of the Hotelling model in this analysis. Hotelling (1929) investigates the determination of price between two competing firms who distribute products at different locations from each other. The equilibrium states that each of the two firms will locate as close as possible to the other firm. However, the Hotelling model cannot be applied to this analysis for the following two reasons. One is that the two goods are

assumed to be homogeneous products and therefore not product differentiated; the other is that there is competition over price but not other location factors. As a result, the model of price-level adjustment without product differentiation cannot be compatible with location analysis, as the latter assumes that product differentiation always exists, unless the market price is at a sufficiently high level.

Instead of these approaches, this analysis can be examined in terms of rivalry and cooperative choices for supply areas between two firms. In this analysis, there will be severe competition between the supply areas of two firms as their economic space is very limited and close to each other. These firms choose either rivalry or cooperation. In this case, cooperative behaviour is preferred when their transportation rates are at a sufficiently high level. As examined in Beckmann (1968), two firms can share transportation methods. This enables both firms to achieve certain cost savings, by applying economies of scale and sharing fixed costs, particularly in the case where specialized shipping is required for both brands of product. In addition, under the assumption of product differentiation, the two firms may have joint production in the upstream production stages as each firm produces similar goods. However, cooperative behaviour may not be observed if there is a severe spatial competition over occupying consumer demand in market areas. As a result, the duopoly model of this spatial pattern also relies on the condition of demand for both brands. This is more plausible in this spatial pattern, as the two brands share the same market areas implying that there is high demand for these brands. In this way, the condition of supply areas depends not only on the transportation network system but also on the structure of market areas.

*Figure 2. Demand cone and transportation rate changes*

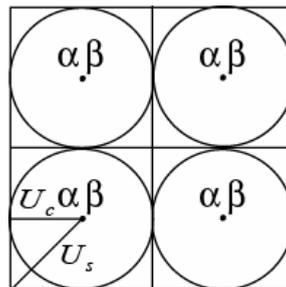


There is one more thing which should be examined in this spatial pattern with respect to high transportation cost for output. Under the condition of the

*f.o.b.* pricing system, certain levels of increase in transportation rate, reduce the volume of demand cone, as examined in Lösch (1954). In figure 2, the original demand cone for the market area is illustrated as  $DC_1$ . In the figure, a highly increased distribution rate of transportation  $t$  shifts the demand cone to  $DC_2$ . For reasons of simplicity, let us assume that the end of the market-area radius for  $DC_2$  is  $U_c$  which equals the half distance between the center of the two brands and the end of the market area. Similarly, the end of the market-area radius for  $DC_1$  is  $U_s$  which equals half the diagonal distance of the market area of the two brands.

As illustrated in figure 3, the original demand cone  $DC_1$  forms square market areas as previously defined in figure 2. The alternative demand cone  $DC_2$  forms circular market areas with radius  $U_c$ . Due to the increase in transportation rate  $t$ , consumers located in the outer circle will be excluded from the market of these products  $a$  and  $b$ . In order to avoid the consumer exclusion, the local authority pays subsidies to fill the space, or another brand  $g$  will enter to the market. If brand  $g$  appears in the market, the spatial structure becomes an overlapping oligopoly situation. Although the space is completely filled by the three firms in this circumstance, there are still consumer exclusions. Some residents have choices of all brands  $a$  and  $b$ ,  $b$  and  $g$ , or  $a$  and  $g$ . This type of consumer exclusion of oligopoly case will be further explored in later Case D.

**Figure 3. Consumer exclusions in perfectly overlapped duopoly market areas**



### 3.2. Overlapping Duopoly Market Areas and Product Differentiation (Case B)

A partly overlapping duopoly market area and the relevant supply areas will be demonstrated under the condition of product differentiation. This case shows that there are two brands  $a$  and  $b$  in the market and that their market areas overlap but do not share the center of these areas. In this case, consumers

choose either brand according to consumer preference between the two brands. As a result, this analysis requires to draw on consumer theory. The examination procedure will be as follows. If a consumer prefers brand **b** to **a**, his utility maximization behaviour can be stated with the expression  $\mathbf{a} \prec \mathbf{b}$ . Using this term, a representative consumer's utility maximization problem can generally be denoted as the following statement.

$$\begin{aligned} &\text{maximize} && U = U(\mathbf{a}, \mathbf{b}) \\ &\text{such that} && M = P(p_a \cdot q_a) + (1 - P)(p_b \cdot q_b) \\ &\text{where} && P = 0 \text{ if } \mathbf{a} \prec \mathbf{b} \\ & && P = 1 \text{ if } \mathbf{a} \succ \mathbf{b} \end{aligned}$$

where  $U$  = consumer's utility function,  $M$  = consumer's budget constraint and  $P$  = parameter. As denoted in the above statement, this consumer cannot maximize his utility by the combination of two brands: he can do so only by choosing either brand **a** or **b** if the product is too expensive to purchase two brands, i.e., in the case of a car or a fridge.

Figure 4 illustrates Case B where brand **a** and brand **b** have different centers but share the same market areas. In this figure, either brand **a** or **b** is chosen by consumers according to the balance between consumer preference and transportation costs to the distribution point. This is a trade-off interaction between preferences of goods and the additional transportation cost burden.

**Figure 4. Overlapping market areas**

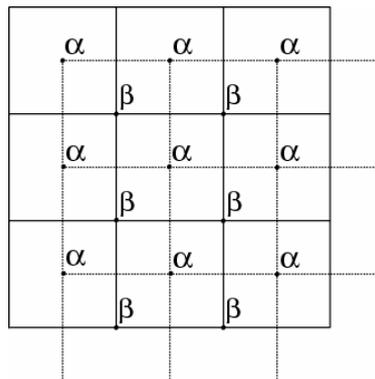
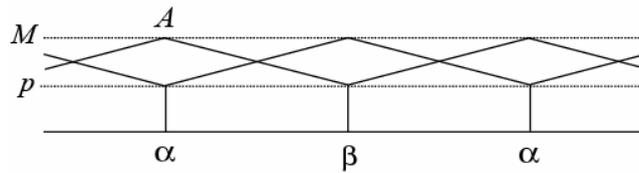


Figure 5 illustrates the *f.o.b* price and consumer budget constraint  $M$ . In this case, a consumer **A** located at **a** will choose brand **b** over the nearer brand

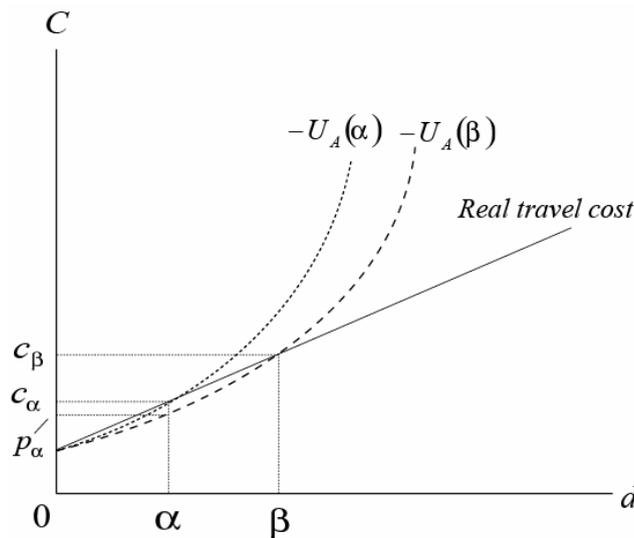
$a$  if he prefers brand  $b$  and his payoff  $p$  for  $b$  as  $p_b$  satisfies the condition  $p_b > M - p$ .

Figure 5. Output price and budget constraint



The above case shows that he is located at the distribution of brand  $a$ . This is an extreme case and consumers may be located at any points between the distributions of the two brands. In order to consider a more general condition, let us assume that there is a consumer who prefers brand  $b$  to  $a$  but is located closer to the seller of brand  $a$ . In this case, if his preference for brand  $b$  is weaker than the additional transportation cost burden, he will give up obtaining brand  $b$  and compromise to purchase brand  $a$  from the nearer seller. However, if his preference for brand  $b$  is stronger than the additional transportation burden, he will put up with travelling a long distance and paying a higher price to purchase brand  $b$  from a distant seller. From the time-leisure standpoint of view, it can be stated that the temperate-humidity index will increase as the travel distance increases.

Figure 6. Travel cost and consumer preferences



Let us suppose that figure 6 illustrates the physical constant travel cost curve and two disutility curves  $-U_A(\mathbf{a})$  and  $-U_A(\mathbf{b})$  of this consumer  $A$  for obtaining brands  $a$  and  $\mathbf{b}$ .

The above figure shows that consumer  $A$  will choose brand  $\mathbf{b}$  even though the nearer seller is brand  $a$ . At the location of brand  $a$ , this consumer can purchase brand  $a$ . However, his disutility curve for brand  $\mathbf{b}$  is lower than for brand  $a$  at this point. If  $-U_A(\mathbf{b})$  exceeds the line of actual travel cost at location  $\mathbf{b}$ , he will not travel to obtain  $\mathbf{b}$  and instead purchase brand  $a$  as a compromise. This index of compromise can be measured as  $c_a - p_a$  in the above figure. In this case, he will be able to obtain brand  $\mathbf{b}$  at the cost of  $c_b$  without compromising the value of  $c_a - p_a$ . This disutility curve can also be examined with respect to substitution and income effects of the properties of complementary goods.

The formal representation of this spatial consumer utility-maximization problem can be stated with the travel costs  $t_a$  and  $t_b$  to the distribution point of the brands  $a$  and  $\mathbf{b}$ :

$$\begin{aligned} \text{maximize} \quad & U = U(\mathbf{a}, \mathbf{b}) \\ \text{such that} \quad & M = P \cdot (p_a + t_a) \cdot q_a + (1 - P) \cdot (p_b + t_b) \cdot q_b \\ \text{where} \quad & P = 0 \quad \text{if } \mathbf{a} \prec \mathbf{b} \\ & P = 1 \quad \text{if } \mathbf{a} \succ \mathbf{b} \end{aligned}$$

As previously examined, the above case also shows that the consumer cannot choose both brands  $a$  and  $\mathbf{b}$  but can choose either  $a$  or  $\mathbf{b}$ . In addition, consumers will access another market area if their preferred brand is not available within the market area. This can be illustrated by the ideal range. If a consumer locates at the center of brand  $a$ , he will be able to obtain brand  $a$  without any shipping cost. However, if his preference is denoted as  $P = 0$  in the above condition, he will travel to the distribution point of brand  $\mathbf{b}$ . In this case, his ideal range can be illustrated as the subscribe circle of the brand  $a$  market area as shown in figure 7. The size of the ideal range depends on the relative levels of price  $p_i$  and distribution transportation rate  $t_i$  ( $i = a, \mathbf{b}$ ) between the two brands.

Regarding the producers, there are four centers of brand  $\mathbf{b}$  at the market-area boundary of brand  $a$ . Similarly, there are four centers of brand  $a$

at the boundary of brand **b**. The relevant supply areas can be illustrated in figure 8. In this case, the supply areas will not necessarily be shared between two firms if the condition of limited supply does not exist.

Figure 7. The ideal range where  $P = 0$

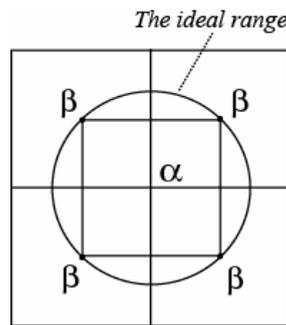
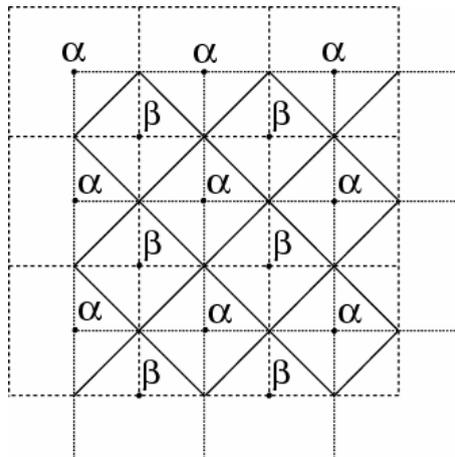


Figure 8. Supply areas of overlapping market areas



#### 4. A MULTIPLE-CENTER EXCLUSIVITY-AREA MODEL

##### 4.1. Duopoly and Exclusivity of Market Areas (Case C)

This spatial pattern shows that there are two types of similar brands *a* and *b* on an economic plain and that each brand is exclusively distributed to each market area. Thus, there is no overlapping area, as illustrated in figure 9.

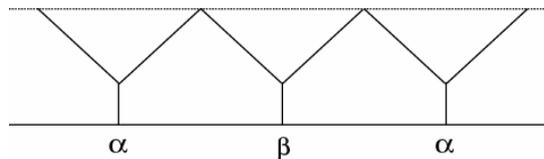
This particular duopoly model can be observed in the following economic circumstances. As shown in figure 10, there is an extremely high level of distribution transportation rate. In addition, this level is too high to

distribute goods over more than half of the market area. In this case, the two brands may have a spatially dispersed and exclusive market area structure. The second case is where there is an extremely high level of assembly transportation rate for processing each brand, and the size of each market is small enough to avoid spatial confliction.

*Figure 9. Exclusive duopoly spatial structure of market areas*

|          |          |          |
|----------|----------|----------|
| $\alpha$ | $\beta$  | $\alpha$ |
| $\beta$  | $\alpha$ | $\beta$  |
| $\alpha$ | $\beta$  | $\alpha$ |

*Figure 10. Exclusive duopoly market areas*



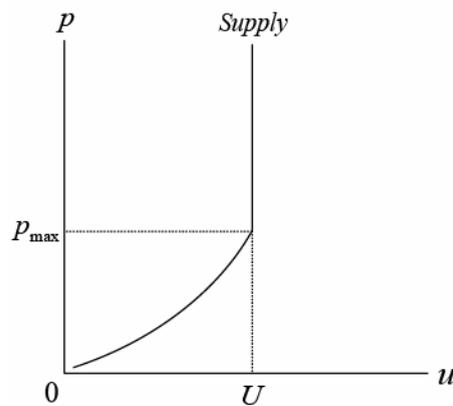
This approach can also follow the economic law of market areas. When the price levels and transportation rates of both products are equivalent,  $p_a = p_b$  and  $t_a = t_b$ , the boundaries will be shown as in the above figure. Alternatively, it is not necessary to satisfy  $p_a = p_b$  and  $t_a = t_b$  if  $p_a + t_a = p_b + t_b$ . It should be noted that this spatial allocation also corresponds to the supply areas if other variables are indifferent to market areas.

However, if  $p_a \neq p_b$  and  $t_a \neq t_b$ , the supply-area size can differ from the size of market area, even though the above alternative necessary condition  $p_a + t_a = p_b + t_b$  is satisfied, since supply-area size relies also on factor price and assembly transportation cost.

This example can also be found in the following three cases. First, when the size of market areas is extremely large, the feasible distance of delivery is limited by this size, and the relevant competitors cannot overlap their

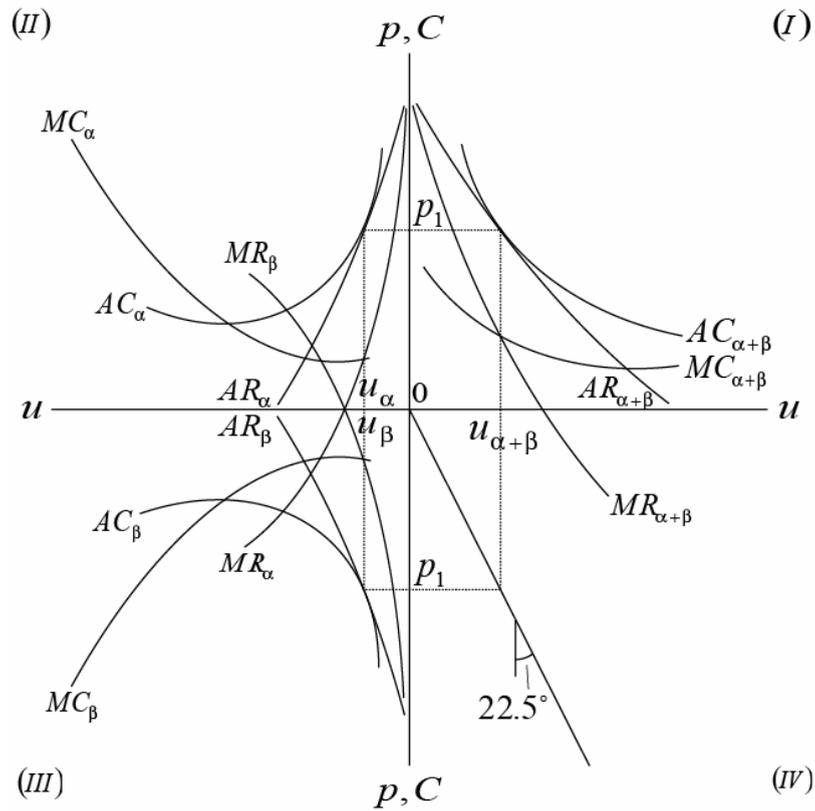
market areas. Second, when the optimal production scale is very small, individual firms cannot satisfy the entire demand of the market areas and their feasible size of market area is limited below the overlapping level. Finally, when Cournot's (1838) duopoly equilibrium is applied, in which unprofitable price adjustment is replaced by quantity adjustment, excess demand will appear and a single firm cannot occupy the entire market. In these cases, the economic plain can be shared between two firms without overlap. In this case, consumers have to accept an elastic supply curve condition beyond certain levels of market price as shown in figure 11.

Figure 11. An inelastic supply curve



This Case C can demonstrate a spatial equilibrium under the conditions of duopoly and exclusive structure of market areas. The equilibrium model is illustrated in figure 12. In this figure, Phase (I) shows the spatial equilibrium of two market areas, Phase (II) depicts the spatial equilibrium in the market area provided exclusively with brand **a**, Phase (III) shows spatial equilibrium in a market area provided exclusively with brand **b**, and Phase (IV) represents the 22.5° reflection line, which is the half of the 45° reflection line, which connects Phases (II) and (III) to Phase (I). If the market areas of the two brands do not have a symmetric price condition, this 22.5° reflection line will become more or less steep in order to adjust the aggregate level in Phase (I). Thus, the slope of this line represents the price ratio of market areas between the two brands **a** and **b** on the plain. However, the condition of equal market-area size level  $u_a = u_b$  must be satisfied as shown in the figure. This situation, where the same market-area size level but different output level between two brands, can be observed where the transportation rate for either distribution  $t$  or assembly  $t$  of one brand is higher than the other. This is one of the ways that the products are differentiated with respect to location analysis.

Figure 12. Spatial duopoly and exclusive structure of market areas



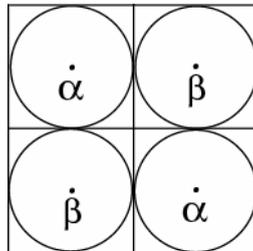
In this case, consumers located at the site of the higher-price brand face consumer exclusion as they cannot choose the less expensive brand due to accessibility in terms of budget constraint. Likewise, consumers located at the site of the other brand in the market area also experience consumer exclusion, as they cannot choose the higher-price brand even if they are willing to obtain this product.

There is one more instance of consumer exclusion in this case of spatial pattern. As shown in figure 13 consumers located at the outer circles of each market area cannot obtain any products if the transportation rate and price are at a sufficiently high level.

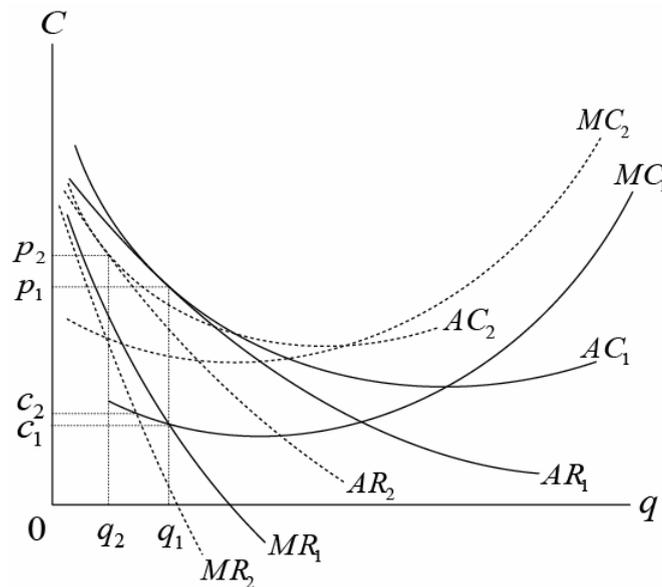
In order to avoid this problem, the local authority may provide subsidies and entire areas will have a space-filling economic pattern. Otherwise, another brand  $g$  may enter the market to fill the entire space and form an oligopoly structure. In this new-entrant case, consumers in each market area of brands  $a$

and **b** will be reduced certain volume of output. If these potential losses exceed cost minimizing circular strategy, two existing brands *a* and *b* will occupy a square space-filling spatial structure without relying on public subsidies. These losses can be explained by the cost of changing to a smaller scale of production facilities and by the decreased amount of revenue from reduced sales of outputs. This is shown in figure 14 by changes in cost and revenue curves. In other words, the optimal output level is reduced from  $q_1$  to  $q_2$ . In addition, the corresponding cost and price levels  $c_1$  and  $p_1$  are increased to  $c_2$  and  $p_2$ , respectively.

**Figure 13. Market areas and consumer exclusions in duopoly case**



**Figure 14. Production scale changes and alternative spatial structure**

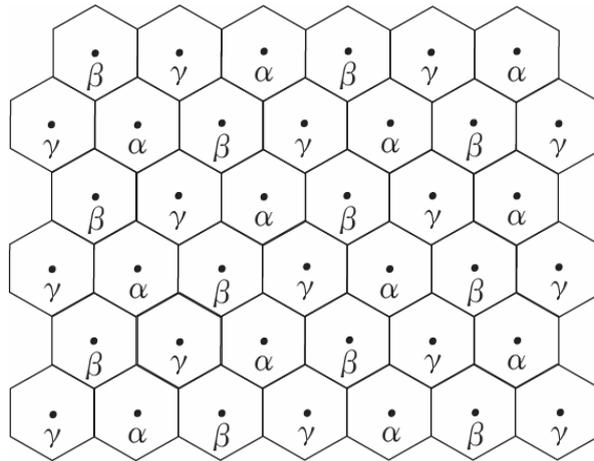


#### 4.2. Oligopoly and Exclusivity of Market Areas (Case D)

This case will introduce three completely product differentiated brands,  $a$ ,  $b$  and  $g$ , distributed by three independent companies. The previous cases examine duopoly models where two different brands  $a$  and  $b$  fill the economic space in either an overlapping or exclusive form, and potential new entrants to the market can also be observed. In the cases that follow, the market areas will be of a regular hexagonal oligopoly form once a new entrant joins the market and all firms achieve space-filling equilibria. The situation is either mutually exclusive market areas or perfectly overlapping. The former pattern is shown in figure 15. These types of spatial pattern are examined as the  $n$ - competitor case of the duopoly model.

There is one more case of a space-filling structure which is an intermediate case between the above two types. This case occurs when the following three conditions apply. First, the entire market area is too large for every brand to be sold. Second, there are insufficient numbers of consumers in each market area for every brand. Finally, the assembly plant of each brand must be dispersed across the economic plain. This final condition is due to the fact that the relevant volume of deposits of inputs is limited per square-kilometer and the assembly transportation rate is at a high level. This figure forms a symmetric hexagonal market-area and supply-area structure. However, they are completely different from the other existing hexagonal spatial analysis.

*Figure 15. Market-area and supply-area territories between three different firms*

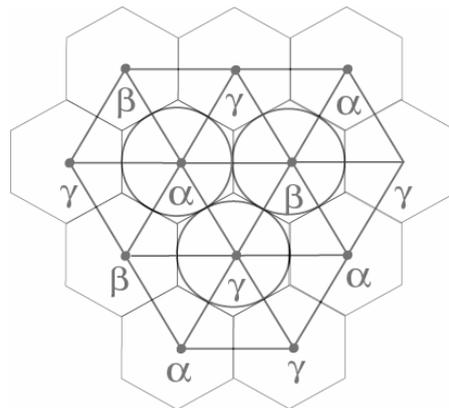


This particular case in the diagram is observed only if a further three conditions are assumed. First, there are three independent companies and each

company has the same conditions for operating their economic activity. Second, no market areas overlap in order for the exclusivity condition to be strictly kept in the assumption. Finally, the three different products are complementary in order for there to be no incentive for displaying preference for one of the brands.

There can be consumer exclusion in some areas, for example outside the circles shown in figure 16. In this oligopoly case, these areas are smaller than those of the duopoly case since the oligopoly case forms regular hexagons while the duopoly forms squares. It can be interpreted from this case that if the local authority considers subsidizing the industry to support consumer demand, the oligopoly case will have a lower cost structure than that of the duopoly square case.

*Figure 16. Market areas and consumer exclusions in oligopoly case*

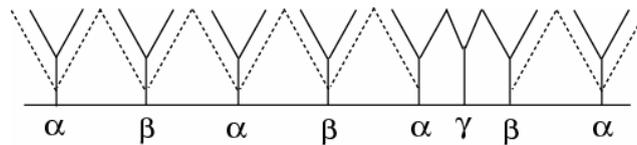


The formation of duopoly or oligopoly spatial structures with respect to consumer exclusions and price adjustment can be summarized by the following four types of attributes. The duopoly situation is maintained when the existing two firms reduce their price levels down to consumer's maximum reservation price level in order to avoid a new entrant to the market. Another case is when these existing firms receive subsidies from local authorities for the equivalent amount of price reductions. These effects are shown as the changes to the dashed price line in figure 17.

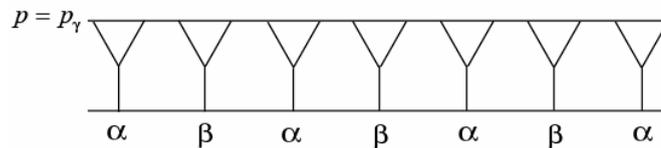
By contrast, the duopoly situation is not maintained and the market becomes an oligopoly when a new entrant  $g$  locates between the two brands  $a$  and  $b$ , or a new entrant  $g$  sets a *c.i.f.* price setting which is equivalent to the level of the maximum consumer reservation price. The former case is illustrated in the above figure as  $g$  between two existing brands  $a$  and  $b$ . The latter case

is achieved if the saving cost for the establishment of a new distribution point between two brands  $a$  and  $b$  exceeds this *c.i.f.* pricing level for brand  $g$ . This price level is illustrated in figure 18.

**Figure 17. Price reduction and entrant barrier**

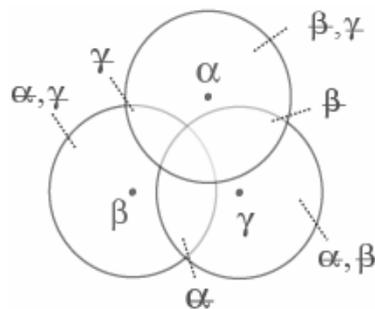


**Figure 18. New entrant with the uniform *c.i.f.* price  $P_g$**



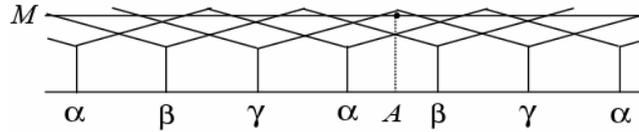
The last case enables all consumers to have two choices from two brands and contribute to prevent consumers from consumer exclusions. In terms of consumer exclusions, the overlapping market-area pattern between three brands is preferred to the exclusive market-area circumstance. However, in the case of partly overlapping market areas with three brands, there may still be consumer exclusion of one or two brands. As shown in figure 19, in part of market area  $a$ , all three brands are available to some consumers. However, either  $b$  or  $g$  are not available to other consumers. In addition, neither brand  $b$  nor  $g$  is available in some areas. These exclusions are caused by the combination of the partly overlapped spatial structure of the market areas and the high rate of the *f.o.b.* transportation rate of outputs.

**Figure 19. Consumer exclusion in overlapping oligopoly case**



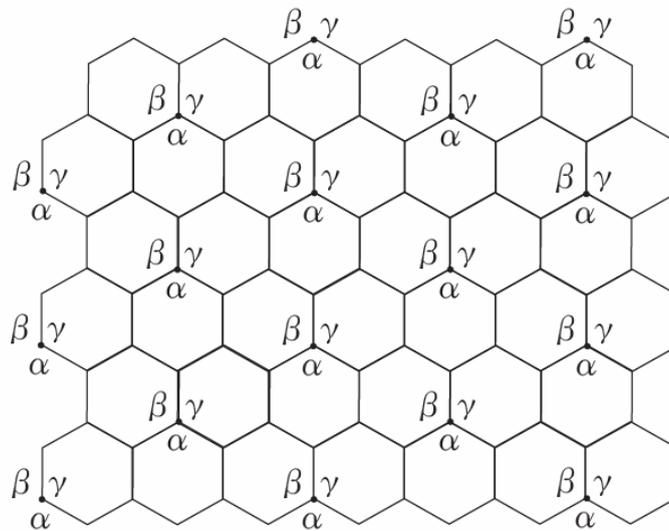
The above argument can be more precisely examined in figure 20.

Figure 20. Consumer exclusion for brand *g* in overlapping oligopoly case



In the above figure, the line *M* represents the budget constraint of a representative consumer. For instance, a consumer *A* who locates between the distribution points of brands *a* and *b* is able to choose from these two brands. However, he cannot purchase brand *g* at this location as the *f.o.b.* price of brand *g* at location *A* exceeds his budget constraint level *M*. As previously examined, this problem may be solved by a subsidiary payment from the local authority should they wish to guarantee its availability.

Figure 21. The optimal firm location in terms of the integrated framework

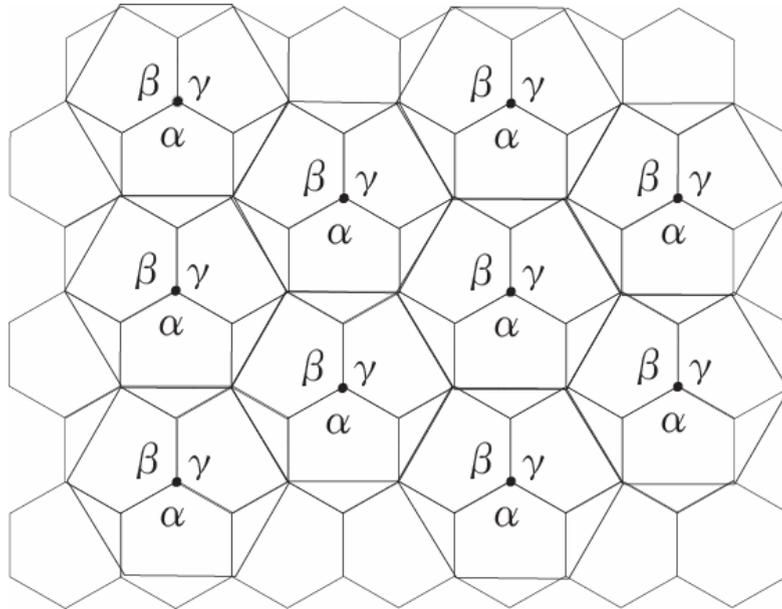


As shown in earlier, figure 15 illustrates a spatial pattern where three brands *a*, *b* and *g* exclusively occupy every market area. In this case, all processing may be engaged independently. If the center of each market area is a metropolitan area, the situation could be changed as examined in the notion of urbanization diseconomies. If the product does not require to have location proximity to the metropolitan area, firms tend to avoid locating at the center due to the presence of urbanization diseconomies. In this case, firms will locate closer to the spatial boundary and other producers. If all three producers come closer to each other due to mutual attempts to avoid production at each

metropolitan area, and they are producing product-differentiated but similar types of goods, the three firms can situate at a common location and have certain types of agglomeration economies. Under the condition of a uniform spatial pattern, the optimal firm location can be illustrated in figure 21.

The relevant supply-area configuration can be shown as figure 22, if other conditions are kept constant. The alternative market-area configuration also becomes the same shape. In this way, including the concept of agglomeration economies may change the structure of market-area and supply-area configuration. Not only does this bring cost savings for producers; it also solves the problem of consumer exclusion for particular products.

**Figure 22. The alternative market-area and supply-area configurations**



Thus, this is one of the Pareto improvement solutions which are brought about by the consideration of agglomeration economies. However, it should be noted that there may still be possibilities to have consumer exclusions when the distribution transportation rate increases and market areas become circular configurations. In addition, if the transportation network has an important role for this activity, the production should be operated on the triangular transportation network as demonstrated in Beckmann (1968). In this way, agglomeration economies and transportation costs cannot be excluded from the analysis of firm location with respect to the integrated framework of market-area analysis and supply-area analysis.

## 5. CONCLUDING COMMENTS

This paper initially outlines a theoretical framework involving hypothetical examples, and then introduces a typology of four cases of spatial structure to reveal the mechanism of the several irregular spatial formations of market areas and the corresponding structures of supply areas. From these attempts, it is revealed that plant location is not required to be investigated, as the individual firm is considered to be operating under optimal-production conditions.

However, if a specific exceptional spatial structure is observed, particular locational patterns and production conditions will require to be investigated, taking into account the spatially unconstrained and constrained internal and external economic factors. In addition, it can be stated that economic policies for solving the spatial consumer exclusion problem can be formed by giving full consideration to the effect of market-area and supply-area configurations on spatially unconstrained and constrained economic factors concerning the location of production firms.

This analysis also provides evidence showing the extent of the importance of the additional locational factors, with respect to the spatial constraints and spatial enhancement forces of economies. However, it should be noted that these hypothetical scenarios require dynamic analysis between upstream and downstream linkages or between earlier and later stages of processing. In addition, certain competition models of entries and exits of firms also need dynamic investigation by the framework of game theory. Related to the game approach, the decision-making between upstream and downstream linkages can be analyzed by observing negotiation process and dominant strategies. Spatial industrial integration and dispersion, or operational integration and disintegration can also be examined on the framework of the transactions and contracts of firms.

In order to observe the motion of individuals, firms, and local authorities in spatial context, these notions of the equilibrium concept should be applied to the analysis of this integrated framework approach. Finally, as demonstrated in the final part of this analysis, economies of scale and entry barriers of fixed costs can be further expanded with respect to the address model, which is the primitive spatial framework in conventional economic theory. Such extensions are beyond the scope of this analysis, however, they can provide a basis for further in-depth investigation into location theory.

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## CONCURRENCE SPATIALE, SYSTÈME DE PLACES CENTRALES ET ÉCONOMIES D'AGGLOMÉRATION

**Résumé** - Cet article montre que l'arbitrage entre économies d'agglomération et coûts de transport est un élément essentiel dans la formation des places centrales. Dans un premier temps, nous examinons les effets de concurrence spatiale entre deux producteurs, selon qu'ils offrent des produits homogènes ou différenciés. Par la suite, nous élargissons l'analyse au cas de l'oligopole. Enfin, un ensemble de problèmes méthodologiques est considéré concernant la relation entre économies d'agglomération et formation des places centrales.