Agglomeration and the Location of Service Branches

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ABSTRACT
Consumers are offered substitute services by different firms each having branches. Examples
are banking services, healthcare providers, insurance companies and their agents, brokerage
firms and their branches. The consumer has to choose both a firm and a branch. In the first
period, each consumer elects to receive services from the branch that minimizes the overall
costs incurred, composed of price per service plus transportation costs. In the second period,
the branches' configuration changes. A new branch is introduced by one of the firms. When
consumers switch firms, they incur additional costs, “switching costs”, the cost of
information, learning costs, transaction costs. The paper deals with the implications of
switching costs on optimal location of new service branches.
Given prices and switching costs, can we select an optimal location for a new branch? We
show that under certain conditions, the best strategy for the firm is to locate its branch
adjacent to the competitor's branches, and under different conditions in a distance. Though
clusters are often explained by consumers minimizing search costs, we conclude that in the
service industry with limited search, clusters can be a result of switching costs. Under certain
conditions, competing firms will cluster their branches to increase their market shares, and to
increase their revenues. Alternatively, the new branch may push the existing branches out of
the market.
1. Introduction

Classical location theory teaches us that firms producing substitute commodities should locate at a distance from each other, so that each gains its own market area. In reality, we observe agglomeration, clusters of firms or facilities that offer close substitutes, e.g., clusters of shops of shoes, cars, clothing and other commodities, or clusters of complimentary goods and/or inputs where linkage relations prevail. Customers are attracted to the variation within the cluster; they search before shopping, and agglomeration reduces search costs (Stahl, 1982). In many cities we observe clusters of branches which offer very close substitute services. However, customers rarely "shop around", and seldom move from one branch to another. Minimizing search costs cannot explain the cluster of service branches. An example is branches of brokerage firms. They are very often clustered - branches belonging to different firms are adjacent to each other. However, customers are loyal for long periods to their own broker and don’t switch between firms and branches. Other examples are branches of banks, insurance agents or medical clinics; again, customers are loyal and don’t switch often between them. The examples in the paper refer to banks and insurance agents, but examples from other areas of service are as good.

Several questions are puzzling. Is there an explanation to the phenomenon that consumers don’t move from one service firm to another? Is there an explanation why branches belonging to different firms cluster? Is there an advantage to proximity? Can we predict firms’ policies in terms of opening of branches?

Hotelling (1929) described competition along a line between two firms. He concluded that two firms selling substitute goods will locate in the center in a cluster. His model is still discussed and extended (e.g., Economides, 1993). I adopt Hotelling’s framework of competition along a line. But, in the analysis firms locate branches, and in the market are more than two branches.

In Baron (2002, 2003) it is conjectured that customers don’t switch often between firms, due to the existence of switching costs, which generate loyalty to the firm. This paper looks for the implications of switching costs in terms of firms’ policies of locating new branches.

Von Weizsacker (1984) and Klemperer (1987a) introduced the term "switching costs" into the economic literature (see also Klemperer, 1987b, 1995, Padilla, 1995, To, 1996). They assume that a customer incurs costs in switching from one firm to another, like ‘learning costs’, ‘transaction costs’, ‘psychological costs’. The consumer adopts one of the firms in the first period, when commodities are offered at different prices. In the second period, if the
consumers want to switch firms they incur switching costs. The result is that customers are likely to be loyal to the firm from which they receive serviced in the first period. Klemperer argued that switching costs result in firms selling at low prices in the first period, trying to capture a maximal market area, and in the second period the firms often increase prices. Two cases are analyzed: "endogenous switching costs" and "exogenous switching costs". Endogenous switching costs occur when firms encourage customers to become loyal by plans like ‘frequent flier’. Customers are offered the commodity at a lower price in the second period, if they remain loyal to the firm. The firm bears the costs, the foregone revenues. If the consumers change a firm, due to the change in the products' prices in the second period, the consumers incur ‘exogenous switching costs’. These costs might deter customers from switching firms, and makes them 'captive customers'. Sharpe (1997) examined the implications of switching costs on the banking industry; Polsky et al. (2000) examined the mobility of practicing physicians.

In Klemperer’s basic model (and those of his followers) it is assumed that consumers enter and exit the market, but firms have a permanent location. Unlike these assumptions, this model reverses the roles and assumes that branches are introduced, but consumers have a permanent location.

In the first period, a set of branches was introduced, so what should be the firms’ policy in the second period? Where should firms locate the new branches? In Baron (2003) it is shown that a firm should not open a branch adjacent to existing branches of the firm, since it will result in intra-firm competition and in a loss to the firm. The firm will not gain new customers, but will incur additional costs. The new branch will generate moves from the existing branches to the new one, but no additional customers are added. The firm should try to locate its new branches adjacent to branches of its competitors, generating inter-firm competition. If certain conditions hold, such a branch will attract customers from the competitor despite switching costs. When the firm introduces a branch between its own branch and a competitor’s branch, the firm will sacrifice some of its customers in the adjacent branch, but that might enable the firm to gain customers from its competitors.

Section 2 describes the baseline model – a line with two branches belonging to two firms that co-exist in the first period. Section 3 discusses the implications of introducing an additional branch on customers, individual branches and firms. Section 4 inquires what is the optimal location of branches given the prices and the switching costs. Location is a decision variable. We specify the conditions where the optimal location is within a cluster or outside. In Section
we provide empirical evidence from the banking and insurance industries in Israel to strengthen the conclusions. Section 6 summarizes the results.

2. Basic Model – First Period

Assumptions
1. The market is represented by a line segment of length 1 [0, 1], along the line customers and service branches are located;
2. The branches belong to two different firms (H, I);
   \{A, B, C\} a set of letters designating the location of branches on the line. \{a, b, c\} the respective distances from the origin. For example, location A is in distance a from the origin (0<a<1).

Branches are designated by firm (H, I) and location (a, b, c), HA, HB, HC, IA…

Only firm H introduces branches in the second period.
3. The branches offer substitute goods;
4. Branches of different firms charge different f.o.b. prices (PH, PI in branches belonging to firms H and I respectively). Branches belonging to the same firm charge the same price. The prices don’t change from one period to another;
5. No capacity constraints apply to the branches. The marginal costs are constant;
6. Consumers are distributed uniformly along the line. A consumer is located at x (0<x<1);
7. Switching costs, S, are incurred when switching from one firm to another. There are no switching costs in switching between branches belonging to the same firm;
8. When the total costs in two branches are equal, the customers adopt the closer branch;
9. Consumers don’t move-in or move-out of the market;
10. Demand is inelastic. Each customer purchases one unit per period;
11. The model is of two periods.

Definitions
Market area, the boundary of the area from where customers patronize a branch, will be designated by [ ]. For a thorough discussion of the law of market areas, see Parr (1995).

Market share is the size of the market area: upper boundary less lower boundary, will be designated by Ψ.

Ψ_{Hi}[a,b] denotes the market share of branch Hi within the range [a, b].
The Model

There are branches in the market (e.g., HA, IB) belonging to firms H, I, where 0<\(a\)<\(b\)<1. Consumers choose a branch that minimizes the total cost of service. The consumer bears the price per service (\(P_H, P_I\)) and the travel cost, since the service is offered in the branch (as is true with discussing a loan, consulting a physician, etc.). The travel cost equals the distance between the place of residence (\(x\)) and the location of the branch (\(a, b\)) times the cost of travel per distance unit (\(t\)); travel costs are independent of the firm which provides the service.

Total Costs, denoted \(CS_{HA}\), of getting service at branch HA (of firm H located at \(a\)), when the customer is located at \(x\) are:

\[
CS_{HA} = P_H + t \vert x-a \vert
\]

Figure 1 shows how the total cost changes with distance. At location \(A\) the customer pays \(P_H\), the height of the perpendicular. Customers who reside at \(x\) have to incur in addition travel cost. The angle of the line is \(t\), the travel cost. The figure is often termed in the literature a tree and the lines are termed ‘branches’, but we shall refer to lines to avoid confusion.

A consumer located at \(x\) chooses branch HA if the total cost, \(CS_{HA}\), is smaller than the total cost, \(CS_{IB}\), of getting service of branch IB (of firm I located at \(b\)).

\[
CS_{IB} = P_I + t \vert x-b \vert
\]

The consumer that is indifferent between the branches, is located at \(z\):

\[
z = \frac{P_I - P_H}{2t} + \frac{a + b}{2}
\]

All consumers with \(x<z\) choose branch HA located at \(a\); all consumers with \(x\geq z\) choose branch IB located at \(b\).

Since the price per service is different between the branches, the extreme case is when one branch dominates the whole market. If \(H(I)\) charges a very low price it will capture all the customers.

Figure 2 shows how the market is divided between the branches. Lines \(LM, MN\) depict the total cost of receiving service in branch HA. Lines \(PQ, QR\) refer to branch IB. Since the branches belong to two different firms, we assume they charge different prices. Since line \(LM\) is lower than line \(PQ\), customers in the range \([0, a]\) will adopt branch HA. Similarly, the comparison between lines \(QR\) and \(MN\) shows the adoption of branch IB in the range \([b, I]\). Lines \(MN\) and \(PQ\) intersect in \(z\). This is the location of the indifferent customer. The customers to the left (right) of \(z\) adopt branch HA(IB).
Proposition 1
If the two firms charge $P_{II}$, $P_I$ and the branches are located at $a$, $b$, then the market has branches from the two different firms, only if the following relationship between the prices holds:

$$P_I - t(b - a) \leq P_{II} \leq P_I + t(b - a)$$

Proof
For proof see Baron (2003)

3. Second Period-Introducing a New Branch
When a firm adds a branch, the customers are faced with the dilemma of being loyal to the branch in which they received service in the first period or moving to the new one. For convenience, it is assumed that switching cost, $S$, is a cost incurred, if switching from one firm to another and not in switching branches within the same firm. It is not difficult to modify the model, and assume that switching costs apply in any move. The results hold as long as the switching costs are lower in changing to a branch of the same firm vs. changing to a branch of a different firm.

Opening a new branch has different implications on branches and on firms. Each branch may gain or lose in terms of its market area, and consequently its market share. Only if a branch gains an additional market share, do its revenues increase. Does it imply that the new branch is profitable? Not necessarily, since we have to deduct the costs of providing service and the fixed costs of opening a new branch. The firm will gain revenues only if the firm’s market share increases. If some of its branches gain customers while others lose them, the question is the sum of changes in market share. The firm’s profit will increase only if the difference between the change in revenues and in costs is positive.

Since the customers don’t know the firms’ future policy regarding opening (or closing) of new branches, it is reasonable to assume that in the first period they are myopic, and make decisions disregarding future changes in the availability of branches.

We proved (Baron, 2003, Sections 4-5) that in cases where the firm introduces a new branch adjacent to its own branches, either on the edge or between two branches, this firm gains no new customers, and opening a new branch will decrease its profits. Locating an additional branch adjacent to a competitor, either on the edge, between two branches, or between one
branch of the competitor and one of the firm itself, the firm will gain new customers only under conditions specified in the above paper. Only the later cases are examined in the next section.

Since we deal with a linear city (assumption 1), the firm can open a new branch in the edge $[0, a]$ or $[b, 1]$ or between two existing branches $[a, b]$. If the first assumption is relaxed, and we deal with a circular city, potential location is only between existing branches.

**Firms operating in the first period in different scenarios:**

$Hi$, where $i=A, B,.. G$ - branches belonging to firm $H$.

$IA, IB$ - branches belonging to firm $I$.

**Branches introduced by firm $H$ in the second period:**

$HD$ - A branch in the edge, adjacent to $IB$.

$HF$ - A branch between branches $IA, IB$.

$HG$ - A branch between branches $HA, IB$.

4. Optimal Location

The firm’s objective is: ‘if prices and switching costs are specified, what is the optimal location of introducing a new branch in terms of achieving a maximal market share’?

This question is different then the one asked in Baron (2003): ‘what are the market areas and market shares given the prices, switching costs and the location of the branches’?

In this Section, the analysis concentrates on the optimal location adjacent to the competitor's branches. We restrict the analysis to the range $[b, 1]$ or $[a, b]$ as specified. We disregard the branch’s success in capturing customers outside the specified range.

Throughout this Section we define:

$$\Delta = (P_I - P_H - S)/t,$$
where $\Delta$ can be positive, negative or zero.

4.1 The Optimal Location of a Branch Adjacent to a Competitor in the Edge (Branch $HD$)

In this Section we search for the optimal location, where the competitor has a branch at $b$, branch $IB$, and firm $H$ considers locating a new branch in $d$, between the branch and the edge, $b \leq d \leq 1$, by calculating the market share in the range $[b, 1]$.

We analyze three cases with regard to the prices charged by each firm: $P_I$ vs. $P_H + S$. Cases (a) and (b) show that when $P_H + S \leq P_I$ in optimal location the firm can gain $1-b$ of the market, but in case (c) where $P_H + S > P_I$, the maximal gain is $1-d (< 1-b)$. We disregard the case where the branch gains no customers, when it is located in a wrong site. In case (a) the optimal location is adjacent to branch $IB$, and a cluster is formed. In case (b), if the newcomer is
located adjacent to branch \( IB \), it will push the competitor’s branch out of the market. Either we shall observe disappearance of branches offering more expensive service, or the branch will be located in a distance and will still gain the (maximal) market share, \( 1-b \). Only in case (c), the branch has to be located in a distance, outside the cluster, in order to gain a market share. Optimal location will result in maximal market share.

Case a: \( P_H+S=P_I (A=0) \)

Figure 3 (case a) shows the determination of the market areas. Receiving service in branch \( IB \) means that the customer is confronted with costs according to lines \( ML, LM' \). If branch \( HD \) is located in \( b+e \), the customer confronts costs according to lines \( P_1Q_1, Q_1R_1 \). The lines coincide for all the customers. According to Assumption 8, the customers adopt the closer branch, i.e., all the customers who reside in \( x>b \) will move to branch \( HD \). Locating in \( b \), branch \( HD \) gains the customers in the range \([b, 1]\), and its corresponding market share is:

\[
\Psi_{HD}[b, 1]=1-b.
\]

If the branch, alternatively, is located in \( d' \), the customer is confronted with \( P_2Q_2, Q_2R_2 \). The customers gained reside in the range \([z, 1]\), where \( z=(b+d')/2 \). The market share equals:

\[
[1-(b+d')/2].
\]

Since \( d'>b \), the result is a decrease of \((d'-b)/2\) in the market share. We conclude that the optimal location, under these prices, is where \( d=b \), and a cluster of branches is formed.

Case b: \( P_H+S<P_I (A>0) \)

If firm \( H \) locates branch \( HD \) at \( b \), it gains all the customers of branch \( IB \), since for all the customers it is cheaper to get service at the new branch. In Figure 3 (case b) the customer is confronted with lines \( P_1'Q_1', Q_1'R_1' \). The lines show that receiving service in the new branch is cheaper for all the customers than in branch \( IB \) (lines \( LM, LM' \)). In this case, branch \( IB \) will lose its entire market share, and will be pushed out of the market.

Branch \( HD \) can be located in \( d>b \), as well (e.g., when rents in \( d \) are lower than in \( b \)), due to the relation of prices. To gain a market share of \( 1-b \), the branch cannot be located too far away from branch \( IB \). The farthest away the branch can be located is where customers in the range \([0, b]\) are indifferent between getting service at the ‘old’ branch or the ‘new’ branch (the customer pays the cost of service, the switching cost if moving to the new branch, and the transfer cost to the branch). The equality of costs applies to all the customers who reside in \( x<b \), and results in:

\[
CS_{IB}=P_1+t(b-x)=P_H+S+t(d*-x)=CS_{HD}=P_H+S+t(d*-b)=P_1 \quad x<b<d^*
\]
In Figure 3 (case b), if branch HD is located in $d^*$:

For all the customers who reside in $x>b$, the costs, $CS_{IB}$, depicted by line $LM'$, are higher than $CS_{HD}$, depicted by lines $LQ_1', Q_1'R_2'$.

For all the customers who reside in $x\leq b$ the costs are equal. See lines $P_2'L$ and $LM$ depicting the cost of service.

If branch HD is located in $d^*$, the customers in the range $[0, b]$ remain loyal in the second period to the branch they adopted in the first period, whereas customers in the range $[b, 1]$ switch to the new branch, HD.

The location derived is:

$$d^* = b + \left(P_1 - P_H + S\right)/t = b + \Delta > b \quad \Delta > 0$$

If the branch is located within the range $[d^*, 1]$, the firm's market share will be smaller. In this case, a cluster is not formed.

**Case c: $P_H + S > P_I (\Delta < 0)$**

If branch HD is located at $b$, the branch cannot gain customers, since for all customers it is more expensive to get service in the new branch, due to the high price firm $H$ charges per service, or the high switching costs. In Figure 3 (case c), the comparison is between $P_1Q_1', Q_1'R_1'$ and lines $LM, LM'$.

If the branch is located towards the edge it might gain customers. The maximal market share for branch HD is calculated based on the costs for customers who are indifferent between the branches. These customers are located in $x \geq d^{**}$. In Figure 3 (case c), the dilemma of these customers is exhibited by line $Q_2'R_2$ which coincides with line $LM'$. According to Assumption 8, the customers move to the new branch HD if they resides in $x \geq d^{**}$. Customers in $x < d^{**}$ remain loyal to branch IB. The optimal location of the branch is where the indifferent customer resides.

$$CS_{IB} = CS_{HD} \Rightarrow P_H + S = P_I + t(d^{**} - b) \quad d^{**} < x < 1$$

The maximal market share equals $1 - d^{**}$. To achieve this market share the branch has to be located at $d^{**}$:

$$d^{**} = b + \left(P_H + S - P_I\right)/t = b - \Delta > b \quad \Delta < 0$$

Customers in the range $[b, d^{**}]$ remain loyal to branch IB due to the high cost of service in branch HD (depicted by line $P_2'Q_2'$). Customers in the range $[d^{**}, 1]$ switch to branch HD, despite the switching costs, due to the higher travel costs if they remain loyal to branch IB.

If the branch is located in the range $d^{**} < d < 1$, its market share decreases.
4.2 The Optimal Location of a Branch Between Two Branches of a Competitor (Branch $HF$)

This Section discusses the optimal location when two branches belonging to the competitor exist in the market in the first period, branches $IA$, $IB$. Firm $H$ considers introducing a new branch in $f$, $a \leq f \leq b$. The optimal location of the branch will depend on its price per service relative to the competitor's, and on the switching costs. Branch $HF$ gains a market area in the range (calculated by comparing the cost of service in the three branches):

$$[\frac{(P_H+S-P_I)}{2t+(a+f)/2}, \frac{(P_I-P_H-S)}{2t+ (b+f)/2}] = \left[\frac{(a+f)/2-\Delta/2, (b+f)/2+\Delta/2}{}\right]$$

The branch’s market share is:

$$\Psi_{HF}[a, b] = (P_I-P_H-S)/t+(b-a)/2=(b-a)/2=\Delta$$

The size of the market share is independent of the location and depends if $\Delta$ is positive, zero or negative. In cases (a) and (b) the branch can be located anywhere within the range and will gain a market share. In case (c) its location is crucial in terms of the firm's success in capturing a market share.

Case a: $P_H+S=P_I(\Delta=0)$

Firm $H$ will gain the same market share no matter where it locates the new branch. Branch $HF$ gains customers from both branches $IA$, $IB$. As the branch is located closer to branch $IA$ it attracts less customers from branch $IB$ (and symmetrically next to branch $IB$). The market share is always $(b-a)/2$ since $\Delta=0$.

If this branch is located in $f=a$, and a cluster is formed, it will attract the customers from half the range $[a, (a+b)/2]$. The other half of the range will be loyal to branch $IB$.

Case b: $P_H+S<P_I(\Delta>0)$

Firm $H$ will gain the same market share no matter where it locates the new entrant and its market share is:

$$\Psi_{HF}[a, b] = (b-a)/2+\Delta>(b-a)/2 \quad \Delta>0$$

Firm $H$ that charges low prices (case b) has a larger market share than in case (a). If it locates where $a=f$, it drives branch $IA$ out of business, but we disregard the gain out of the range. We conclude that the branch can locate outside the cluster.

Case c: $P_H+S>P_I(\Delta<0)$

Firm $H$ will gain the same market share provided that the branch is located within a specified range.
If branch HF locates at a (or b) it will not capture any market area, since branch IA(IB) provides service in a lower price, and for every customer regardless where he resides it is cheaper to receive service at branch IA(IB). The branch will gain a market share if it is located within the range \([l, m]\), where \(l>a, m<b\). The range is calculated using the costs of the indifferent customer: \(P_H+S=P_I+t(l-a)\) \((P_H+S=P_I+t(b-m))\). Branch HF has to be located in the range:

\[a< l=a+(P_H+S-P_I)/t=a-\Delta<f<b+(P_I-P_H-S)/t=b+\Delta=m<b\]

The branch’s market area is \([{(a+f)/2-\Delta/2, (b+f)/2+\Delta/2}]\) and its market share is:

\[\Psi_{HF}(a, b) = (b-a)/2+\Delta\quad a-\Delta \leq f \leq b+\Delta, \Delta < 0\]

If the branch is located outside the range, the market share is zero. In this case, the branches do not generate a cluster.

4.3 The Optimal Location of a Branch Between Branches of Two Firms (Branch HG)

This Section discusses the case where the new branch is located between two branches belonging to two firms: branch HA belonging to firm H, and branch IB belonging to firm I. We look for an optimal location for branch HG in the range \(a \leq g \leq b\).

The branch always splits the market area with branch HA, since the prices charged are identical. We need to calculate the location relative to branch IB. The new branch will capture branch IB’s market if the service price is relatively low.

Case a: \(P_H+S=P_I(\Delta=0)\)

Firm H will gain the maximal market share, if it locates branch HG adjacent to branch IB, in b. In this case the branch captures the whole market area of branch IB in the range \([a, b]\). It will split the market area with branch HA (both branches belonging to firm H). The branch’s market share equals \((b-a)/2\). The firm will hold a market share of \(b-a\) in the second period. If the branch is located outside the cluster, at \(a < g < b\), the branch’s and the firm’s market share decrease.

Case b: \(P_H+S<P_I(\Delta>0)\)

If firm H locates the branch in b, it will push branch IB out of business. The branch will capture branch IB’s market share in the range \([a, b]\) even if it locates at \(g<b\). The farthest away it can locate is where \(P_H+S+t(b-g)=P_I\). The location derived is:

\[g^* = b-(P_R-S-P_H)/t=b-\Delta<b\]
The firm's market share is the sum of the market shares of branches $HA$ and $HG$ and equals $\Psi_H = b-a$.

The branch’s market share is:

$$\Psi_{HG} = (b-a)/2 + \Delta/2 > (b-a)/2.$$ 

If the branch is located within the range $[g^*, b]$, it does not capture all the customers of branch $IB$ and its market share is lower.

**Case c: $P_{H}+S>P_{I}(\Delta<0)$**

If branch $HG$ is located at $b$, it will not capture any market area. If it moves to the location where $P_{H}+S=P_{I}+t(b-g)$, then it can capture a market area. The optimal location $g^{**}$ is where:

$$g^{**}=b+(P_{I}-P_{H}-S)/t=b+\Delta \text{ where } \Delta<0.$$

The branch’s market share equals  $\Psi_{HG} = g^{**}-(g^{**}+a)/2 = (b-a)/2 + \Delta/2$ 

The firm’s market share equals: $\Psi_H = g^{**}-a = b-a+\Delta \quad \Delta<0$

As $g$ increases the market share increases.

If the branch is located farther away from branch $IB$, its market share decreases.

4.4 **Optimal Location and Agglomeration**

The market share of the introduced branch varies between the cases and is summarized in Table 1. If the service price ($P_{H}+S$) is very low relative to the competitor’s price, the new entrant can push the competitor’s branch out of the market. In this case, we might observe disappearance of branches from the market. Alternatively, the branch can be located in a distance from its competitor, but still attract its competitor’s customers. Such a policy, can be advantageous if the land prices are lower in a distance.

If the service price is the same in both branches, e.g., the switching costs are negligible, and the price charged is the same, we might observe formation of clusters. In order to gain a maximal market share the branch has to be located adjacent to its competitor.

If the service price is relatively high, the new branch cannot locate adjacent to its competitor, else it will not attract any customer. To guarantee a market share it has to be located at a distance.

The location adjacent to a competitor means that a cluster is formed, and we witness agglomeration. Agglomeration is formed mostly when $P_{H}+S \leq P_{I}$, i.e., when the new branches charge a low price relative to the competitor. As the price is lower the market share increases, and the branch will gain the market share even if it is located outside the cluster.
Table 1: Summary of Results

<table>
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<th>$\Delta^* &gt; 0$</th>
<th>$\Delta^* &lt; 0$</th>
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<tbody>
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<td></td>
<td>Optimal Location</td>
<td>Market Share</td>
<td>Optimal Location</td>
</tr>
<tr>
<td>Edge</td>
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<td>$1-b$</td>
<td>$b &lt; d &lt; b + \Delta$</td>
</tr>
<tr>
<td>Between Branches</td>
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<td>$\frac{(b-a)}{2}$</td>
<td>$a \leq f \leq b$</td>
</tr>
<tr>
<td>Between Firms</td>
<td>$b$</td>
<td>$\frac{(b-a)}{2}$</td>
<td>$b - \Delta \leq g \leq b$</td>
</tr>
</tbody>
</table>

*$\Delta = \frac{(P_l - P_h - S)}{t}$, where $\Delta$ can be positive, negative or zero.

5. Empirical Evidence

Empirical evidence strengthens our conclusions. It is brought from the banking and insurance industries in Israel.

The Banking Industry

Data on the change in the number of firms and of branches in a period of 40 years (1950-1990) is consistent with our conclusions. In this period, the number of firms decreased from 108 to 26; the number of branches increased from 204 to 1038 (from two branches per firm in average, to 40 branches per firm). These data relate to two phenomena: The more expensive firms are taken over by inexpensive firms, and over time the number of firms decreased. The firms that stay in the market capture an increasing market share by introducing new branches. Therefore we observe an increasing number of branches per firm. These two phenomena existed despite the increase of population from 1.3 million to 4.7 million.

The phenomena of agglomeration is examined with data from the banking industry. Figure 4 shows data from the city of Haifa and its vicinity (located in the north of Israel). The map depicts the dispersion of branches belonging to the five major banks (firms) in the city. The city is divided into statistical units and the number of branches in each unit is indicated. We observe large areas with no branch, only few statistical units with adjacent branches (the largest number, five branches). The high concentration is in the centers of commerce, but in most residential areas there is not a single branch. The clustering of branches might be clearer if we had been able to perform a GIS analysis, where the clustering would be shown in small geographical units.
The Insurance Industry

Figure 5 shows data from the city of Haifa as well. The map depicts the dispersion of branches belonging to registered insurance agents in the city. In each statistical unit the number of agents is counted.

The number of agents is much larger than of bank branches, therefore the scale reaches forty agents in a unit. But the picture repeats itself. Large areas with no branch, and few statistical units with concentration of agents. The maximal number of agents is in the same statistical areas as the peak in the location of banking branches.

6. Conclusions

The question of agglomeration of service branches was neglected in the literature. Though, agglomeration of shops, industrial plants, etc. is discussed, service branches were not analyzed. Search Costs cannot provide an explanation to the clusters, since customers rarely search and change a provider. Assuming that switching costs explain consumer’s loyalty, their implication on location are analyzed.

We can generalize that if switching costs are negligible, and the prices charged by the incumbent branch, $P_I$, and the introduced branch, $P_H$, are equal, the optimal location is adjacent to the competitor’s branch, and a cluster is formed.

If the price charged by the introduced branch is lower, and the branch is located adjacent to the competitor’s branch, the introduced branch will push the competitor out of business. The branch will capture the total market area of the competitor, even if it is located in a distance from the competitor’s branch. A cluster will not result in this case.

If $P_H$ is higher than $P_I$, and especially when the switching costs are not negligible, the newcomer must be located in a distance from the incumbent branch, else it will not gain any market share. The market share is lower than in the other cases, but with optimal location can justify introducing a new branch.

We have to be careful with the empirical evidence. The data from Israel, does not relate to a line, as in the model, and we cannot assume uniform distribution of the population. However, the data indicates that firms disappear from the market, and the number of branches per firm is increasing steadily. The data also indicates that the branches are located in clusters, as expected, which is especially clear in the insurance industry.
References


**Nomenclature**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
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<tbody>
<tr>
<td>$\Psi$</td>
<td>Market share</td>
</tr>
<tr>
<td>[ ]</td>
<td>Market area</td>
</tr>
<tr>
<td>$A, B, C$</td>
<td>Location</td>
</tr>
<tr>
<td>CS</td>
<td>Cost of service</td>
</tr>
<tr>
<td>$H, I$</td>
<td>Types of firms ($i=H, I$)</td>
</tr>
<tr>
<td>$HA, HB, HC, IA, IB…$</td>
<td>Branches of firm $i$, location $j$ ($i=H, I; j=A, B, C$)</td>
</tr>
<tr>
<td>$P_i, P_H$</td>
<td>Price charged by firm $i$</td>
</tr>
<tr>
<td>$S$</td>
<td>Switching costs incurred in moving between firms</td>
</tr>
<tr>
<td>$t$</td>
<td>Price of travel per distance unit</td>
</tr>
<tr>
<td>$z$</td>
<td>The border between market areas</td>
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</tbody>
</table>
Figure 1: Total Cost of Receiving Service at Branch H4
Figure 2: Determining the Market Areas of Branches $H_A$ and $B$
Figure 3: Determining the Market Area of Branch   \( HD: \text{ Case a} \)
Figure 3: Determining the Market Area of Branch \( HD: \text{Case } b \)
Figure 3: Determining the Market Area of Branch

HD Case c
Figure 4: Number of Banking Branches per Statistical Unit, in Haifa, Israel, 1999
Insurance Agents, Haifa