The Impact of Switching Costs on Closing of Service Branches

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ABSTRACT

The paper deals with the location of service branches. Consumers can receive service from different firms and branches offering substitute services. The consumer chooses the firm and the branch. Examples are banking services (which firm and branch?), healthcare providers, insurance companies and their agents, brokerage firms and their branches. With the change in the accessibility of the internet, the service industry witnesses the impact of the change in technology. More customers prefer acquiring services over the internet or phone, and less require face to face contacts. The industry has to respond in limiting the number of branches. The paper deals with the question which branches to close.

In the first period, each consumer selects to receive service 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 branch is closed by one of the firms in alternative locations. When consumers switch a firm, additional costs, "exogenous switching costs" are incurred, the cost of information, learning costs, transaction costs. These costs are incurred by the consumers, and are different from "endogenous switching costs" that are incurred by firms, e.g., the 'frequent flier' case.

The paper investigates how the market area and market share of branches and firms change with the closure of a branch. The loss varies between no loss to losing the whole market. Given the prices, the switching costs and the location, the branches to be closed are identified.

1. Introduction

The paper deals with the location of service branches. Consumers can receive service from different firms and branches offering substitute services. The consumer chooses the firm and the branch. Examples are brokerage firms (which firm and branch?), insurance companies and their agents, banking services and their branches. The service industry witnesses the impact of the change in technology. More customers prefer acquiring services over the internet or phone, and less require face to face contacts. The industry has to respond in limiting the number of branches. The paper deals with the question which branches to close.

Baron (2002a) argues that customers don't switch often between firms, due to the existence of *switching costs.* 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 purchased in the first period. Two cases are analyzed: "endogenous switching costs" and "exogenous switching costs". Endogenous switching costs exist 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 bear 'exogenous switching costs'. These costs might deter the 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 closed in alternative locations*, but *consumers have a permanent location.*

As is shown in the paper, it will be to the firm's advantage to close branches located adjacent to each other, since the firm will not lose any customer. In closing branches between the competitor's branches (or adjacent to them), the firm might lose all its customers or retain some (or all) of its customers under certain conditions. Under conditions specified in the paper, the firm can avoid losing customers, despite the closure of a branch.

Section 2 describes the baseline model – a line with two branches belonging to two firms that co-exist in the first period (a Hotelling framework). Section 3 discusses the general impact of closing a branch and introduces the terminology.

Sections 4-5 have propositions regarding the market share of a firm closing a branch when prices, switching costs and location vary. Section 4 discusses the case when a branch is closed in an edge adjacent to the firm's branch or between two branches of the firm. We conclude that a firm should adopt such a policy. Section 5 discusses the case when the branch is closed adjacent to its competitor's branches, or between branches of two firms (the firm itself and its competitor). Closing a branch might be profitable to the firm, under conditions specified in the propositions. 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 closes branches in the second period.

3. The branches offer substitute goods;

4. Branches of different firms charge different f.o.b. prices (P_H, P_I 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.

$\Psi_H (x \in Hi)$ denotes the market share of firm H (the closing firm) with respect to the customers that in the first period belonged to the branch closed Hi.

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:

$$CS_{HA}=P_H+t|x-a|$$

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*).

$$CS_{IB}=P_I+t|x-b|$$

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 $x>z$ 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.

Proposition 1

The market has branches from two different firms, only if the following relationship between the prices holds:

$$P_I - t(b-a) \le P_H \le P_I + t(b-a)$$

Proof

The proof is by contradiction. Let us assume that the price firm H charges is below the price range:

$$P_H < P_I - t(b-a)$$

By comparing CS_{HA} and CS_{IB} we conclude that for all customers in the segment $[0, 1]$ it is   cheaper to get service at HA than at IB, and nobody will get service at IB. To exemplify, let us examine a single range which is closer to branch IB: $[b, 1]$

$$CS_{HA}=P_H+t(x-a)<[P_I-t(b-a)]+t(x-a)=CS_{IB} \qquad b<x<1$$

We conclude that firm H controls the whole market, which contradicts the presumption regarding the market.

If the price firm H charges is above the range, it is equivalent to claiming that the price firm I charges is relatively low, and firm I controls the whole market, which is a contradiction:

$$P_H > P_I + t(b-a) \Rightarrow P_I < P_H - t(b-a)$$

If the sign turns from inequality to equality, where $P_H=P_I - t(b-a)$ then: for customers residing in the range $[0, b]$ it is cheaper to receive service in HA and they will adopt branch HA. In the market area $[b,1]$ the customers are indifferent between the branches. According to assumption 8 (equality between costs) the customers in the range $[b,1]$ adopt the closer branch, i.e., branch IB. Both branches co-exist, and their market areas

are [*0, b*], [*b, 1*] respectively. Similarly, when $P_H = P_I + t(b\text{-}a)$ the market areas are [*0, a*], [*a, 1*].

Examples:

If the branches charge the same price, $P_H = P_I = P$, then the market area of *HA* is [*0, (a+b)/2*] and the market area of *IB* is [*(a+b)/2, 1*]. Each customer in the range [*0, a*] will adopt branch *HA*, each customer in the range [*b, 1*] will adopt branch branch *IB*, the customers in the range [*a, b*] are split between the branches.

If the branches are located at the edges *a=0* and *b=1* and the prices are equal, then the firms split the market area, else the market area will depend on the locations *a, b*.

If the branches are located at the edges, and charge different prices, then *HA* and *IB* dominates respectively at:

$$[0, \frac{1}{2} + \frac{P_I - P_H}{2t}] \qquad [\frac{1}{2} + \frac{P_I - P_H}{2t}, 1]$$

3. Second Period - Closing a Branch

When a firm closes a branch, the customers are forced to move to another branch. They might move to a branch belonging to the same firm, or of another firm.

Since the customers don't know the firm's future policy regarding the opening of new branches or closure of 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.

Closing a branch has different implications on branches and on firms. The branch closed loses its market area, and consequently its market share. The implications on the firm are different. If the customers move to another of the firm's branches, the firm loses only some (or none) of its customers. If some of its branches gain customers, the issue is the sum of changes in market share (see Section 4). If the customers move to a branch of another firm, the firm loses its market share.

Five propositions are presented and discussed. The detailed proofs appear in Baron (2002b).

In Section 4, cases where the firm closes a branch adjacent to its own branches are discussed, either on the edge (Section 4.1) or between two branches (Section 4.2). It is claimed that, as expected, this firm loses no customers, and closing a branch will

actually increase its profits. These propositions are trivial, but are brought for completeness.

In Section 5 we examine cases where the closed branch is adjacent to the competitor's branches. Moving to the competitor's branches implies that the consumer bears switching costs (exogenous switching costs). Under certain conditions the customers will move in the second period to remote branches of the 'closing firm' from which services were purchased in the first period. It is argued, that under specified conditions, a non-continuous market area is generated. We explore the impact of the switching costs on the shape of the market area (continuous or not) and on the size of the market share.

Notation

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 closed by firm H in the second period:

HC - A branch in the edge, adjacent to *HA*.

HD - A branch between branches *HA, HB*.

HE - A branch in the edge, adjacent to *IB*.

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

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

4. Closing a Branch Adjacent to Incumbent Branches of the Firm

4.1 A Firm Closes a Branch in the Edge

Firm *H* has branches at *a* and *c,* branches *HA, HC*, which share the market with branch *IB* in the first period $0<c<a<b<1$. In the second period, firm *H* closes branch *HC* in the range [*0, a*]. Branch *HC* has a single adjacent 'neighbor', branch *HA,* belonging to the same firm.

Proposition 2

Closing a branch between the firm's branch and the edge, will not change the firm's market share, but will increase its profits. The 'adjacent' branch will gain all the customers of the 'closing' branch. . The firm's market share in the range will correspond to:

$$\Psi_H(x \in HC) = \frac{a+c}{2}$$

4.2 A Firm Closes a Branch Between Two Branches of the Same Firm

We assume that in the first period, the branches within a restricted segment of the market

[*a, b*] are *HA, HB* and *HD* where *0<a<d<b<1*.

The price per service in the three branches is the same. In the second period firm *H* closes the intermediary branch, *HD*.

Proposition 3

The market share gained by branches due to the closing of an intermediary branch of the same firm, is independent of the location of the 'closing' branch and equals half the distance between the 'remaining' branches. The market share of firm *H* remains unchanged; closing the branch increases the firm's profits.

4.3 A Firm Should Close the Branches Adjacent to Other Branches of the Firm

Though the 'closing' branches were profitable, in terms of the 'closing' firm, closing the branches will increase the firm's profitability.

- The consumers move from one of the firm's branches to another;
- No customers are lost to the firm in the second period;
- The firm's revenues remain unchanged (by Assumption 10);
- The total costs are lower (by Assumption 5, the variable costs are unchanged, since the number of customers is unchanged; the fixed costs of an additional branch are saved);
- The firm's profits increase.

The conclusion might change, if Assumption 5 is relaxed, and the capacity of the branches is limited or marginal costs are increasing.

For completeness: switching costs will not change the propositions, since by assumption, switching costs apply only in switching between firms and not in switching between branches of the same firm.

Firm *H* attracts the same customers with or without switching costs.

5. Closing a Branch Adjacent to Incumbent Branches of a Competitor

5.1 A Firm Closes a Branch in the Edge, the Adjacent Branch Belongs to a Competitor

Three branches belonging to two firms are in the market, *HA*, *IB*, *HE* ($0<a<b<e<1$). Firm *H* closes branch *HE*. If the customers move to branch *IB,* the adjacent branch, they incur *switching costs*. Branch *HA* is more remote. Will firm *H* lose the market share of the 'closing' branch, $\Psi_H\,(x \in HE)$, or under certain conditions retain its share, since the customers move to the more remote remaining branch, *HA*?

There is no adjacent branch closer to the edge next to the closing branch, since we discuss competition over a line. If we analyzed a circle and the closer branch belonged to firm *H* then see Sec. 5.3. If the branch belonged to the competitor, see Sec. 5.2.

Proposition 4

A firm closing a branch, in an edge adjacent to a competitor's branch, will lose customers as a function of the price charged, the location of its remaining branches and the switching costs. The firm's market share in this range will correspond to:

$$\Psi_H(x \in HE) = \begin{cases} 0 & P_H \geq P_{I\,-}t(b-a)+S \\ 1\text{-}[(\,b+e)/2-(P_I\text{-}P_H)/2\text{t}] & P_H < P_{I\,-}t(b-a)+S \end{cases}$$

We conclude that if P_H is relatively high (relative to P_I), the switching costs are relatively low and the distance between the potential branches (*b-a*) is high, the 'closing firm' (firm *H*) will lose all the market share of the closing branch. If the customers remain loyal to the closing firm, they move to the more remote branch of the firm (branch *HA*). The result is a non-continuous market share.

5.2 Closing a Branch Between Two Branches of a Competitor

In the first period, five branches are located within a restricted segment of the market: *IA*, *IB* and *HC, HE*, *HF* ($0<c<a<f<b<e<1$). The branches divide the market area between them in the first period. In the second period, branch *HF* (belonging to firm *H* and located at *f*) is closed. If the customers move to the competitor's branches (*IA* or *IB),* switching costs apply, since we analyze two different firms. Will they move to more remote branches belonging to the 'closing firm' (*H*) and remain loyal to the firm they adopted in the first period?

Proposition 5

The market share of a firm closing a branch between two branches belonging to a competitor depends on the prices, the switching costs and the location of branches.

$\Psi_H(x \in HF) =$

$$
= \begin{cases}
\dfrac{b-a}{2} + \dfrac{P_I - P_H}{t} & P_H - S < P_I - t(a-c) \bigcap P_H - S < P_I - t(e-b) \\[2ex]
\dfrac{(b-a)}{2} + \dfrac{P_I - P_H}{t} - \dfrac{f-c}{2} + \dfrac{S}{2t} & P_H - S < P_I - t(a-c) \bigcap P_H - S \geq P_I - t(e-b) \\[2ex]
\dfrac{(b-a)}{2} + \dfrac{P_I - P_H}{t} - \dfrac{e-f}{2} + \dfrac{S}{2t} & P_H - S \geq P_I - t(a-c) \bigcap P_H - S < P_I - t(e-b) \\[2ex]
0 & P_H - S \geq P_I - t(a-c) \bigcap P_H - S \geq P_I - t(e-b)
\end{cases}
$$

The customers' decision depends on the distance between the potential branches: *IA* vs. *HC, IB* vs. *HE*. As the distance is increasing, it is less likely that the firm will keep the customers. Other cases that the firm will lose its customers are when the switching costs are low and the price the firsm charges is relatively high. As the switching costs are higher, it is more likely that the firm keeps the customers. If the customers are loyal to the firm, then the resulting market area is non-cotinuous.

5.3 Closing a Branch between Branches of Two Firms

In the first period branches of different firms co-exist in the market. We concentrate on four branches at the range [*a, b*]: branches *HA, HE, HG* and *IB* ($0<a<g<b<e<1$). In the second period the 'closing firm' (*H*) closes the branch at *g* (branch *HG*). Its adjacent neighbors are one belonging to the same firm and one to its competitor. We assume that switching costs apply when a customer moves his business to the competitor (branch *IB*), switching between firms, and don't apply when customers move to a branch of the same firm (branch *HA* or branch *HE*).

Proposition 6

The market share of a firm closing a branch between branches of two firms - one belonging to a competitor and one to the same firm - depends on prices, switching costs and the location of branches.

The firm's market share is:

$$\Psi_H(x \in HG) = \begin{cases} (b-g)/2 + (P_I + S - P_H)/2t & P_H \geq P_I - t(e-b) + S \\ (b-a)/2 + (P_I - P_H)/2t & P_H < P_I - t(e-b) + S \end{cases}$$

If the switching costs are high, all the customers will be loyal to the firm, and the firm retains its market share as in the first period. In this case the customers will split between the adjacent branch belonging to the 'closing firm' and a more remote branch (branches *HA* and *HE*). Due to the switching costs it is cheaper to get service in *HE* and not in the closer branch *IB*. This result also depends on the distance *e-b*. In this case, the resulting market area is non-continuous.

If these conditions do not hold, the firm will lose some of its market share to its competitor. Its market area will be continuous. Its market share will depend on the distance between the competitor's branch and the closing branch, *b-g* . It will increase as the switching costs are increasing.

5.4 Should a Firm Close Branches Adjacent to its Competitor's Branches?

When a firm closes one of its branches adjacent to its competitor's branches, it is faced with the risk of losing the entire market area and market share of this branch. As Propositions 4, 5 and 6 show, the loss depends on the difference between the prices charged by the firms (P_H, P_I), the distance between potential branches and the switching costs.

In Sections 5.1, 5.2, and 5.3, the customers of the closed branch are faced with a choice between two branches (the 'potential branches'), each with a different cost per service: A branch belonging to the competing firm, and an alternative, a remote branch belonging to the 'closing firm'.

If *m* denotes the location of the branch belonging to firm *H*, and *n* the location of the branch belonging to firm *I*, and $m < n < x$. The costs of service are:

$CS_{Hm} = P_H + t(x-m)$

$CS_{In} = P_I + S + t(x-n)$

The comparison is equivalent to comparing the costs at the same location, arbitrarily, the location of the competitor's branch. If we are located at *n*, receiving service at

branch *In* we shall pay the price the firm charges (P_I) plus switching costs (no transfer costs), P_I+S.

The costs relevant for branch *Hm* equal the price per service (P_H) plus the transfer cost between the two branches, $P_H+t(n-m)$.

According to Proposition 1, we know that the co-existence of branches in the market implies $P_H+t(n-m)\geq P_I$. In the second period, the consumer's comparison of costs includes switching costs, and they may reverse the sign of the inequality. In such a case, the more remote branch is adopted by the customers (branch *Hm*), and not the close branch, branch *In*.

As long as the switching costs are low, all the customers move from the closing branch to its closest neighboring branch. In Sections 5.1, 5.2, a branch belonging to the competitor, firm *I*. In these cases, firm *H* loses its entire market share in the considered range. In Section 5.3 the closing firm loses about half of its market share, since one of its closest neighbors is a branch belonging to the firm itself.

Once the distance between the potential branches is relatively small and the switching costs are relatively high, it is likely that the customers will remain loyal to firm *H*. If that is the case, the result is that some of firm *H*'s branches have a *non-continuous* market area. Some of the customers of these branches belonging to firm *H* reside adjacent to the branch (the customers who patronized the branch in the first period), but other customers, don't reside adjacent to the branch (the ones who moved in the second period from the closing branch).

The difference between the propositions is in the impact of the switching costs. In Proposition 4, the change in market share is not continuous. For a wide range of values of the switching costs, firm *H* will lose all the customers of the closing branch. Once, the switching cost is above a 'critical value' the firm retains all its customers. The 'critical value' depends on the travel cost between the potential branches. Therefore, either firm *H* loses all the customers of the closing branch or it retains all of them. In Propositions 4, the results are independent of the location of the closing branch.

In Propositions 5 and 6, the impact of the switching costs is more gradual. If one of the competitor's branches is attractive enough, the boundary between the market areas depends on the switching costs. The market area gained by the competitor depends negatively on the switching costs.

In Propositions 5 and 6 the market share lost or retained depends on the location of the closed branches. The market share depends on the distance between the closing branch and the adopted branch (e.g., in Proposition 6, *b-g*).

If the firm loses all its customers, its profit will decrease in the second period, assuming the branch was profitable in the first period. As the firm retains more of the customers of the closed branch, its profits are more likely to increase. The firm saves the branch's fixed costs, and its revenues might be close to the initial level (in the first period).

6. Conclusions

The service industry witnesses changes. Face to face contacts are less crucial. The branches are losing many of their customers, and firms' survival depends on closing service branches. Though the analysis assumed inelastic demand for services, we can infer from the analysis into the real world.

A firm trying to increase its profits should close all the branches adjacent to other branches of the firm, according to Propositions 2 and 3. When closure of branches adjacent to the competitor's branches is considered, the Propositions suggest rules for choosing the branches to be closed. The propositions identify branches that their potential decrease in market share is minimal, e.g., the case where the competitor's branch is adjacent to one of the firm's branches.

The discussion shows the importance of switching costs in the decision to switch a firm and in the size of the resulting market share. The discussion assumes that switching costs are exogenous: the consumer bears the switching costs. We can reformulate the problem and assume both exogenous and endogenous switching costs. The consumer continues to bear the costs and inconvenience of switching a firm. However, the firm that wishes to retain (or attract) the old customers offers a bonus to any customer who moves to its branches when a branch is closed, and is willing to bear endogenous switching costs. Each firm can use the bonus to increase its market share, if it is willing to bear the costs.

Though it is assumed that the transfer rate, *t*, is the same for both firms, we receive a non-continuous market area, a result Parr (1995) receives only when the transfer costs applying to two firms are different. This results from consumers' loyalty and is an unexpected result.

The results show that switching costs have an important role in changing the market areas and shares. They can be used by firms to increase their profits, and cannot be neglected.

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Nomenclature

Ψ	Market share
[ ]	Market area
A, B, C	Location
CS	Cost of service
H, I	Types of firms ($i= H, I$)
HA, HB, HC, IA, IB...	Branches of firm i, location j ($i=H, I$; $j=A, B, C$)
P_I, P_H	Price charged by firm i
S	Switching costs incurred in moving between firms
t	Price of travel per distance unit
z	The border between market areas

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