University of Augsburg
Prof. Dr. Hans Ulrich Buhl
Research Center
Finance & Information Management
Department of Information Systems
Engineering & Financial Management

Universität Augsburg
University

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Multi-Channel Pricing for Financial Services

by

Jochen Dzienziol, Michael Eberhardt, Annette Renz, Jürgen Schackmann

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Universität Augsburg, D-86135 Augsburg
Visitors: Universitätsstr. 12, 86159 Augsburg
Phone: +49 821 598-4801 (Fax: -4899)
www.fim-online.eu

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Abstract

For several years, the financial services industry has discovered the opportunities of different channels like the Internet, call-centers, WAP etc. Many banks built up separate direct banks focusing exclusively on the Internet and/or call-centers. Only recently, some banks started to reintegrate the direct banks with their traditional brick-and-mortar banks in order to offer services over several channels for the convenience of their customers.

However, each channel induces additional fixed costs and the channels may influence each others' turnovers and profits. Therefore, the question of how to price different products and services in different channels arises. In order to solve this problem with regard to profit maximization, it is not sufficient for financial services providers to consider only the cost structure of their channels. Rather banks have to incorporate effects like customer's willingness-to-pay for certain products and services over different channels, cross-selling interdependencies between the channels and marginal costs of each channel.

This paper will provide further insight in pricing-strategies in a multi-channel-world by a microeconomic model. By considering the combination of financial services and delivery channels as versioned products, we can model an efficient, profit-maximizing channel pricing strategy also regarding cross-selling effects. Furthermore, conclusions about the profitability and utilization of certain channels can be drawn.

1. Introduction

Mergers, massive staff reduction and the closing of many branches in the financial services industry (FSI) have shown that it was undergoing a major revolution in the sales and distribution structure of many financial service providers (FSP) within the last years. During the past decade, a declining profitability of the traditional brick-and-mortar branch as the most cost-intensive distribution-channel (cf. p. 6 [8]) could be noticed. In consideration of that fact, many FSPs have established new additional channels like Internet or call centers, which promised lower distribution costs for the FSPs (p. 6 [1]) and at the same time offered more convenience for the customers. Especially in Germany, the appearance of these new channels came along with the foundation of completely independent so called direct banks (cf. p. 3 [8]) in the first half of the 90's. However, a channel-reintegration strategy of the traditional brick-and-mortar FSPs to offer their customers real multi-channel oppurtunities and improve their own profitability, could be noticed lately. This development in the FSI can be compared to a shift from a "competing channel model", in which every channel has its own and independent capability and (IT-) infrastructure to a "managed competition model" with a central management and clear transfer rules and interfaces between the different channels [5]. A FSP's central channel management with a multi-channel-strategy offers its customers more independence in dimensions of convenience, room and time, since it is their choice to select the best channel to make a certain transaction (e.g. remittances) depending on their current situation. Especially, through less time-intensive channels like the Internet or call centers customers' utility, satisfaction and willingness-to-pay can be increased. Therefore, multi-channel-management is an instrument to improve customers' loyality and increase the customer-life-time-value (cf. [3], [7]). Furthermore, the different channels can not only be used for the distribution of certain transactions, but also for marketing purposes: since these new channels respectively the combination of them increase market transparency and reduce search costs (cf. [12]), which makes competition and gaining new customers easier. Besides,

multi-channel-management is an important enabler for a successful customer-relationship-management and the individualization respectively customization of products, because it allows to deliver the right goods to the right persons at the right time (cf. [10]).

On the other side, multi-channel-management faces additional fixed costs for establishing new channels, which might not be covered through the additional turnover created by the customer base and new customers. Within this context, channel conflicts like cannibalization have to be mentioned: instead of increasing profit through new customers, the establishment of new channels might just redirect the turnover from another channel. However, cannibalization might be compensated by certain spillover and cross-selling effects, which may increase the FSP's turnover and profits and enlarge customer relationship in some cases.

In order to utilize multi-channel chances and simultaneously minimizing their risks, profit-maximizing pricing-strategies are inevitable instruments for modern FSPs. Multi-channel-management should enable the direction of particular customers segments to the corresponding profit maximizing channels (i.e. channels with lower marginal costs, e.g. Internet [1]) via multi-channel pricing.

To give useful hints for the pricing in a multi-channel world, the paper first discusses the current situation of multi-channel pricing in chapter 2. In the following chapter 3, a microeconomic model is introduced, by which there will be discussed the profit-maximizing pricing of basic financial services that are versioned through the distribution via different channels. Furthermore, chapter 5 extends the model and introduces cross-selling considerations. Chapter 6 and 7 give final implications about the relevance of the illustrated model in the FSI.

2. Multi-Channel Pricing

This chapter presents the state-of the-art of multi-channel pricing. Afterwards, pricing strategies in the context of this paper are explained in detail and the arising research questions are stated.

2.1 State-of-the-art

Although pricing is a very important instrument to direct customers to the desired profit maximizing channel, the authors have not found any literature with quantitative respectively microeconomic approaches of pricing-strategies in a multi-channel-world. Many FSPs that are concerned with multi-channel-management right now are mainly dealing with organizational aspects of their sales structure and the distinguishable measurement of performance of their single channels. Most of the research work is done in the field of technical realization of multi-channel-strategies, like e. g. Buhl and Will [2] have shown in their project work with German Advance Bank. Nevertheless, a FSP needs quantitative approaches for a successful handling and controlling of such multi-channel-architectures or -organizations in order to handle the trade-off between additional costs and sales of such a concept. Currently, several marketing-software-providers like the British Engage (www.engage.com) offer e-business applications. Siebel Systems (www.siebel.com) offers with its ISS (Interactive Selling Suite) a sell-side e-commerce application that offers a customer-centric configuration and dynamic pricing functionality to maximize the value of each customer interaction. However, the underlying quantitative approaches behind these “profit-maximizing” solutions are unknown. There is also no explanation for non-intuitive effects of the reality, like “negative prices” for remittances via Internet or transfer payments among different channels. E.g. German HypoVereinsbank pays each customer of their 3D account 0.5 DM per transaction up to 18 times per quarter. There is no also no explanation why remittances via call center, which are nearly as expensive as via the branch (cf. [8]), are free of charge by many FSPs.

2.2 How it works

To illustrate pricing-strategies in a multi-channel-world and explain effects described above, in the remainder of this paper a simple microecomic model based on the view of a monopolistic FSP, that provides certain services through different channels, is used. Thereby, a service, that is provided through several channels, is interpreted as a version of this service and will be denoted channel versioned service. The monopolistic situation is noticed in reality since in a short- and mid-term consideration the installed customer base of a FSP faces switching costs and will not change its provider. Based on an empirical study Simon and Crameri [8] have mentioned that customers of the Swiss bank Credit Suisse could be divided in five different customer groups with homogeneous behavior. This can be used within the model by splitting the customer base into several homogeneous segments. Subsequently, each customer segment has different costs, like transaction or search costs, but also opportunity costs and more psychological components like the discomfort of using an insecure or impersonal channel. These are issues that have escpecially arisen with the advent of electronic markets [9] in the FSI. E.g. customers are feeling strong safety concerns regarding their personal data transmitted via the Internet. Besides, the lack of face-to-face contact with a financial advisor by using online-banking and the absence of trust-relationships are matters that may accrue the customers' costs. On the other hand, the advantages of the Internet (e.g. convenience, rapidity, actuality and transparency) will reduce the costs of using this channel.

Besides the customer side, also the FSP's cost structure consisting, of annual fixed costs and marginal costs (distribution and marketing channels already exist and remain existing in a mid- and short-term consideration) has to be considered in a profit-maximizing price-setting. The FSP maximizes its own profit via price setting with respect to the constraint of customers' utility maximization. The largest potential of multi-channel pricing strategies might be the possibility of cross-selling. Thereby, cross-selling, a term often used in

marketing contexts, describes the effect of consumers buying additional services which they only get to know through the purchase of a certain service. This effect could be especially interesting for the FSP, if the unknown additonal service offers high margins because of low productions costs and a high willingness-to-pay (e.g. standardized life insurances). Concerns about cannibalization effects can be neglected in our model, since Ward and Morganosky [11] have shown that this effect is compensated by cross-selling in some cases. They have illustrated that in several product categories gathering online information – which can be also considered as a product (often with a price of zero) – seems to increase purchases in other channels like the brick-and-mortar branch. These cross-selling interdependencies are regarded in our model by assuming certain "cross-selling-probabilities".

2.3 Research questions

The following resaerch questions are tried to be answered in the remainder of the paper, using the implications of the microeconomic model:

- Is there a possibility at all to direct particular customer segments to certain channels via price-setting?
- Are negative price as they are noticed in reality reasonable with respect to the constraint of profit-maximization?
- What are the consequences of cross-selling interdependencies for a multi-channel pricing strategy?
- Under which circumstances should certain channels be offered or closed?

3 The Model

In this chapter, we introduce a model that describes an optimal multi-channel pricing strategy for FSPs. While most microeconomic pricing models only consider the optimization of one

particular channel, in this paper the bird's eye view is applied onto several channels through which services are offered (e.g. branches, Internet, call-center, mobile sales forces, WAP). By setting different prices in different channels, a FSP can actively direct customer segments to specific channels and thus maximize its overall profits over all channels. The model considers interdependencies between the various channels, cost differences between the channels, the net utility of customers, and cross-selling effects.

In a first step (chapter 4), a situation is considered where a FSP offers one basic service through several channels to several customer segments. Depending on both, the cost structure of the FSP and the channel specific costs of the customer segments, profit maximizing prices for this service in each channel can be determined.

In a second step (chapter 5), we will introduce the very interesting matter of cross-selling and its influence on the pricing discussion. Therefore, we consider a cross-selling service that is offered in only one of the channels. Thereby, the probability that the supplementary service is bought depends on the channel through which the basic service has been purchased.

3.1 Assumptions

The initial situation is characterized in detail by the following assumptions:

Installed Customer Base

(A1) The customer base of a FSP can be differentiated in i customer segments. Each customer segment i is characterized by its costs c_i^j for using channel j. These (opportunity-) costs include transaction costs like search costs or transport costs as well as more psychological components like the discomfort of using an allegedly insecure or impersonal channel.

Customer Utility

(A2) The customer's utility N of consuming a service does neither depend on the segment a customer belongs to, nor is it influenced by the choice of channel. The utility comprises the basic utility the service offers, i.e. the remittance of a sum of money at a certain date may provide the same utility for each customer. The customer's net utility consists of the utility N of the service less the effective price p^j of the service in channel j, less the costs c_i^j customer segment i faces in channel j. Thus, the net utility can be computed as $N_i^j = N - p^j - c_i^j$ [1]. The customers choose the service-channel-combination

a) that maximizes their net utility N_i^j

b) as long as N_i^j is greater than zero.

FSP

(A3) The FSP has a given, installed customer base and is therefore not competing with other FSPs.

(A4) The FSP offers several services through specific channels to its customers:[2]

a) Basic services: a well-known service to each customer, about which she is very well informed and does not need any further information. The demand of customer segment *i* for a basic service is t_i. The FSP will price this service such that every

[1] The net utility can be interpreted as the personal consumer surplus, as well.

[2] However, this does neither imply that a service is always provided on all channels, nor that a service has to be provided at all (e.g. if it is not profitable).

segment has a non-negative net utility in at least one channel, because all customers have to be served.

b) Cross-selling services *S*: an initially unknown service to the customer. The customer is neither aware of its existence, nor does she have any further information (like the price) about it. The probability x^j that a customer segment learns about service *S* because of cross-selling efforts by the FSP depends on the channel *j* through which the basic service is consumed. If a customer segment does not consume any basic service at all, it cannot learn about service *S*: $x^0 = 0$. The cross-selling service is only provided through one specific channel with a net utility $N^S - c^S - p^S$ for each customer. The demand of customer segment *i* for the cross-selling service *S* is t_i^S.

(A5) The marginal costs of the FSP for providing a basic service in channel j are k^j. Although, it is assumed that all channels are already established, there are fixed annual costs K^j for each channel to maintain its operability, whereby $\sum_{all\ j} K^j$ is denoted $\overline{K}$.

The FSP's marginal costs of the cross-selling service *S* are k^S. There exist no fixed costs for offering *S*, since the channels have already been established for the basic services.

3.2 The customer's point of view – the demand function

The demand D^j of the customers for a service in channel *j* is the sum of demands of the several customer segments. As it was assumed in (A2a,b), a segment's demand for a service through a channel depends on the net utility a service-channel combination offers. Customer segment *i* will buy t_i services in the channel that provides the maximum net utility, as long as

the net utility is non-negative. If it is negative, the customer segment will not purchase the service in the channel. To formulate this situation, we introduce the dummy variable d_i^j:[3]

$$d_i^j = \begin{cases} 1 & if: N_i^j = \max_l N_i^l \geq 0 \\ 0 & otherwise \end{cases} \quad \textbf{(1)}$$

Thus, the demand for a service in channel j can be aggregated over the number of services consumed by all segments in channel j:

$$D^j = \sum_i d_i^j t_i \quad \textbf{(2)}$$

3.3 The FSP's point of view – the profit function

The FSP is supposed to maximize its profit, whereby the overall profit consists of the sum of the channel-specific profits and can be computed as follows:

$$p = \sum_j D^j \cdot \left(p^j - k^j\right) + \left(\sum_i x_i^m \cdot t_i^S\right) \cdot \left(p^S - k^S\right) - \overline{K} \xrightarrow{!} \text{Max}^{\,4} \quad \textbf{(3)}$$

For further economic analysis and interpretation of the multi-channel-prices, the FSP's optimization problem (3) needs to be solved analytically.[5] Therefore in a first step, a situation is considered, where there are only basic services offered through several channels. In a second step, the impact of cross-selling services on the pricing decisions will be analyzed. For

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[3] Thereby, *j* might not only stand for the basic services, but also for the cross-selling service *S*.

[4] *m* denotes the channel through which the basic service is purchased by segment *i*.

[5] Basically, there exist two methods, that can be applied in order to solve this maximization problem: either the simplex optimization algorithm ([6]) or a graphical optimization ([4]), that can only be applied in the two-segment-two-channel scenario. Although both methods will necessarily lead to the same results, for the purpose of illustration in this paper the graphical method will be applied.

simplicity of analysis, but without loss of generality, in the remainder of this paper we will assume that there exist only two customer segments and two channels.

4 Pricing of channel versioned basic services

In the following, two cases have to be differentiated: the company might set prices such that either both segments are directed to the same channel (case 1) or to different channels (case 2).

4.1 Case 1: Both segments are directed to the same channel

If customer segment 1 and 2 are directed to channel j and none to channel k (with $j,k \in \{1,2\} \wedge j \neq k$), the optimization problem with respect to (A2a,b) is as follows:

$$p = (t_1 + t_2) \cdot (p^j - k^j) - \overline{K} \xrightarrow{!} Max \qquad \textbf{(4)}$$

Constraints:[6]

(I) $p^k + c_1^k \geq p^j + c_1^j \Leftrightarrow p^j \leq p^k + c_1^k - c_1^j$

(II) $N - p^j + c_1^j \geq 0 \Leftrightarrow p^j \leq N - c_1^j$

(III) $p^k + c_2^k \geq p^j + c_2^j \Leftrightarrow p^j \leq p^k + c_2^k - c_2^j$

(IV) $N - p^j + c_2^j \geq 0 \Leftrightarrow p^j \leq N - c_2^j$

[6] Constrains (I) and (III) result from (A2a), constraints (II) and (IV) from (A2b).

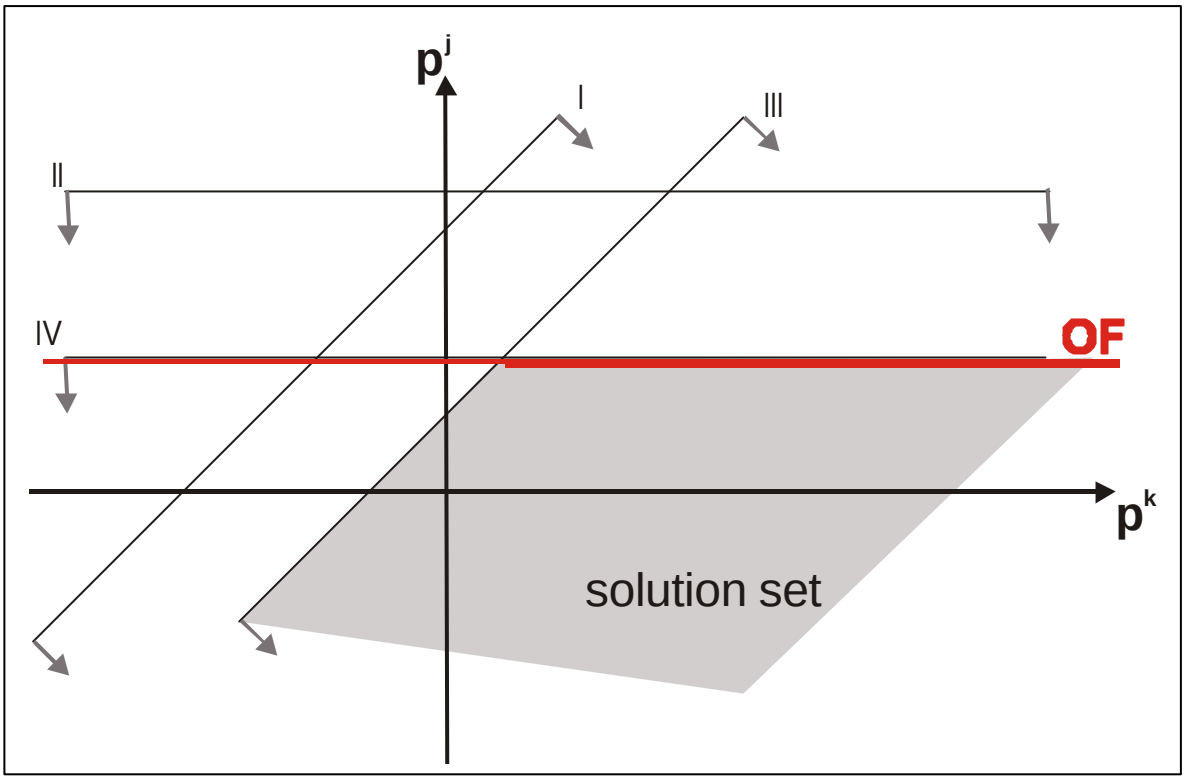

Figure1: graphical optimization of case 1[1]

It can be shown easily that the result of this optimization problem is as follows:

$$p^j = N - \max(c_1^j; c_2^j) \quad \textbf{(5)}$$

$$p^k > N - \max\left(c_1^k; c_2^k\right) \quad \textbf{(6)}$$

$$p = \left(t_1 + t_2\right) \cdot \left(N - \max(c_1^j; c_2^j) - k^j\right) - \overline{K} \quad \textbf{(7)}$$

Analyzing (5) and (7) reveals that the profit-maximizing price equals the utility subtracted of costs on this channel of either segment 1 or 2, depending on which one's costs are larger. This result is intuitive, since (based on (A2) and the constraints (II) and (IV)) the price has to be set in such a manner that both segments have a non-negative net utility on channel j. Therefore, in order to choose the profit-maximizing price, the segment with higher costs on channel j is

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[8] $p^j - p^k = \left(N - \max(c_1^j; c_2^j)\right) - \left(N - \max(c_1^k; c_2^k)\right) = \max\left(c_1^k; c_2^k\right) - \max\left(c_1^j; c_2^j\right)$

relevant, since this segment will put the "cap" on the price. This result is also illustrated in figure 1: the upper graph of (II) and (IV) - and therefore the one with higher costs – determines the price.

However, we have not figured out yet, if it is more profitable to direct both segments to channel *j* or channel *k*. Therefore, we compute the difference of profits between directing both segments to channel *j* or channel *k* and can thereby derive the profit-maximizing-condition (PMC) for channel *j*:

$$p_{\Delta} = p\left(p^{j}\right) - p\left(p^{k}\right) > 0 \quad \Leftrightarrow$$

$$\underbrace{k^{k} - k^{j}}_{a} + \underbrace{\max\left(c_1^{k}; c_2^{k}\right) - \max\left(c_1^{j}; c_2^{j}\right)}_{b} > 0 \quad \Big| \quad j,k \in \{1,2\},\ j \neq k \qquad \textbf{(8)}$$

Part *a* of the PMC ($k^{k} - k^{j}$) is the difference of the firms marginal costs in each channel and can be interpreted as the difference in costs, the firm incurs per service from directing both segments to channel *j*. Part *b* of the PMC $\left(\max\left(c_1^{k}; c_2^{k}\right) - \max\left(c_1^{j}; c_2^{j}\right)\right)$ is the profit maximizing price difference[8] in each channel and can be interpreted as the difference in price, the FSP incurs per service from directing both segments to channel *j*.[9] Therefore, the PMC says that a firm should direct both segments to the channel, where the marginal gain in prices (costs) exceeds the marginal loss in costs (prices).

4.2 Case 2: Customer segments are directed to different channels

If customer segment 1 is directed to channel *m* and segment 2 to channel *n* (with $m,n \in \{1,2\} \wedge m \neq n$), the optimization problem with respect to (A2a,b) is as follows:

$$p = t_1 \cdot \left(p^{m} - k^{m}\right) + t_2 \cdot \left(p^{n} - k^{n}\right) - \overline{K} \xrightarrow{!} Max \qquad \textbf{(9)}$$

[9] It should be mentioned that the difference in both prices and costs might be positive or negative.

Constraints:

(I) $p^m + c_1^m \leq p^n + c_1^n \Leftrightarrow p^m \leq p^n + c_1^n - c_1^m$

(II) $N - p^m + c_1^m \geq 0 \Leftrightarrow p^m \leq N - c_1^m$

(III) $p^n + c_2^n \leq p^m + c_2^m \Leftrightarrow p^n \leq p^m + c_2^m - c_2^n$

(IV) $N - p^n + c_2^n \geq 0 \Leftrightarrow p^n \leq N - c_2^n$

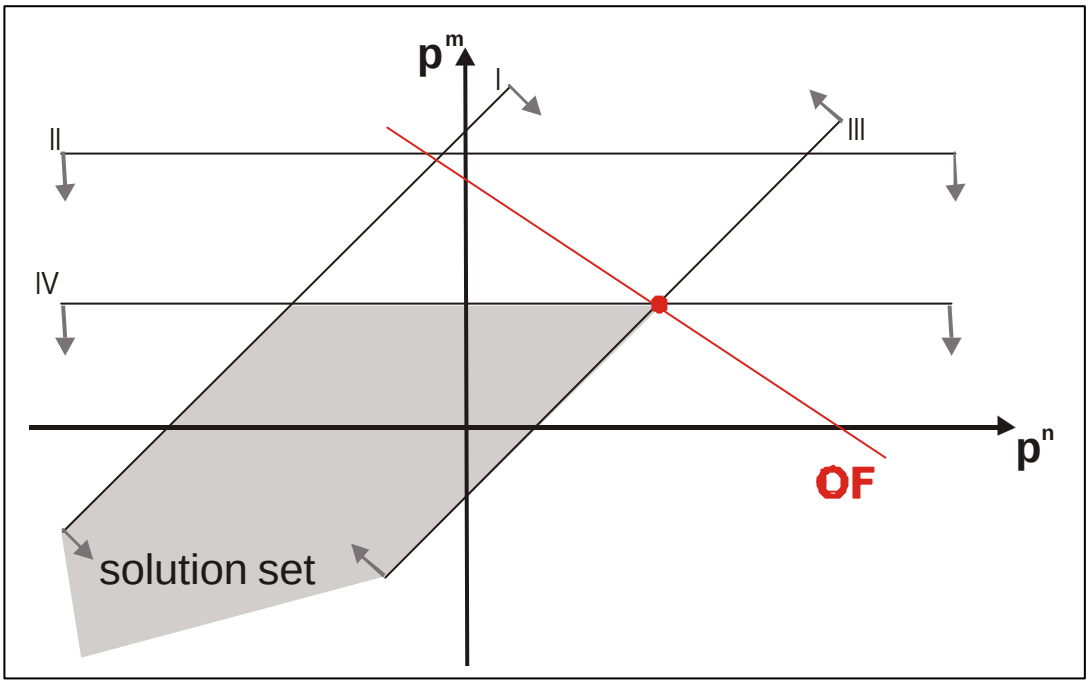

Figure 2: graphical optimization of case 2

It can be shown easily that the result of this optimization problem is:

$$p^m = N - c_1^m + \min(0; c_1^n - c_2^n) \quad \textbf{(11)}$$

$$p^n = N - c_2^n + \min(0; c_2^m - c_1^m) \quad \textbf{(12)}$$

$$p = t_1 \cdot \left(N - c_1^m + \min(0; c_1^n - c_2^n) - k^m\right) + t_2 \cdot \left(N - c_2^n + \min(0; c_2^m - c_1^m) - k^n\right) - \overline{K} \quad \textbf{(13)}$$

Intuitively, with respect to constraints (II) and (IV) the FSP will maximal prices in each channel such that the net utility of each segment is set to zero, i.e. it extracts all the consumer surplus and thereby maximizes its own producer surplus. However, according to this intuition,

if the customer segment with relatively lower costs in a specific channel (i.e. compared to the other segment's costs in this channel) should be directed to another channel, this segment will still purchase through the "wrong" channel, since this difference in costs causes the net utility to be higher. Therefore, in order to off-set this effect, the price in this channel has to be lowered for exactly this difference in costs and will thereby lower the FSP's profits. Consequently, the FSP can realize the highest prices, if it directs each segment to the channel, where it has relatively the lowest cost. Otherwise, the FSP will realize a loss in prices.

In this case the PMC is not relevant, since based on constraint (I) and (III) there exists a condition, that needs to be fulfilled, in order for this case to exist (case existence condition CEC):

$$\underbrace{\left(c_2^m - c_1^m\right)}_{a} + \underbrace{\left(c_1^n - c_2^n\right)}_{b} \geq 0 \quad \left| \quad m,n \in \{1,2\}, m \neq n \right. \tag{14}$$

Part *a* of the CEC is the difference in optimal prices the firm incurs for directing segment 1 to channel *m* and part *b* is the difference in optimal prices the firm incurs for directing segment 2 to channel *n*. The CEC exists, because no segment can be directed to a channel, where the difference in costs is relatively higher, since it would always realize a larger net utility through the other channel. This result can also be concluded from figure 2: in order for a non empty solution set to exist, graph (I) has to be above graph (III).

4.3 Results

It could be shown that the optimal pricing of the channel versioned basic services only relies on the customers' net utility. The FPS's decision, which channel to use, depends on its marginal costs and the customers costs of using the channel. However, no analytical solution, whether case 1 or 2 is profit maximizing, could be drawn from the model. But by computing and comparing the maximum profit in each case, the FSP can easily find the profit maximizing case, which will consequently be chosen.

If case 1 leads to the profit maximizing solution, (8) constitutes the decision rule for the choice of the channel. Thereby, only the marginal costs of the FSP and the costs of its costumers (respectively their differences) in each channel are relevant for this decision. Furthermore, we find that the larger the difference in costs of the customers is, the smaller is the consumer surplus that can be extracted by the FSP and hence the producer surplus. Another property of this case is that the FSP can save the fixed annual costs by closing down the unused channel.

In case 2 the FSP's marginal costs are no longer relevant for the channel decision. The only influencing factors are the customers costs for the different channels. The channel decision is defined exactly by the CEC. Thereby, the profit of the FSP is determined by the difference in costs of the customer: The larger it is, the smaller is the profit.

As in this situation both channels remain established, there are no savings in the fixed annual costs as we could observe in the previous case.

5. Cross-Selling

In our previous analysis, cross-selling was not considered. The decision, whether a customer bought a service or not just depended on her net utility. In reality, customers know some services of a FSP and could evaluate their costs and utility by consuming them. But in an assortment of services, there are usually also many services for which this is not the case, i.e. these services are unknown to the installed customer base. When a consumer buys a service the first time, the FSP has a certain chance to inform the customers about yet unknown services. We think that this chance depends on which channels a customer uses, because of a different quality and also number of customers' contact points. As a consequence, there is a connection between the pricing of services yet known by the customer (basic services) and cross-selling services. To achieve an optimal profit, a FSP has to consider this connection.

Therefore, the optimal pricing strategy and channel decision of basic services in chapter 4 might change.

5.1 Pricing of the cross-selling service

Considering a supplementary service with cross-selling aspects, the FSP has to think about the pricing of this cross-selling service. Regardless of the sales of the channel versioned basic service, the FSP will only try to sell the cross-selling service, if price exceeds marginal costs, otherwise it will set the price that high that no customer will buy. Therefore, the FSP will choose the price as follows:

$$p^S \begin{cases} = N^S - c^S & for \quad k^S \le N^S - c^S \\ > N^S - c^S & for \quad k^S > N^S - c^S \end{cases} \tag{15}$$

Furthermore, the FSP also has to consider the expected demand $x_1^m \cdot t_1^S + x_2^n \cdot t_2^S$ for determining the profit of service S, which depends on the consumption of the basic service offered in channel m and n, with $m, n \in \{1,2\}, m \neq n$).

$$p^S = \begin{cases} \left(x_1^m \cdot t_1^S + x_2^n \cdot t_2^S\right) \cdot \left(N^S - c^S\right) & for \quad k^S \le N^S - c^S \\ 0 \quad for \quad k^S > N^S - c^S \end{cases} \tag{16}$$

Since p^S also depends on the sales of the basic service, it would not be optimal to maximize the profit of service S isolatedly, but to maximize the overall profit $p = p^m + p^n + p^S$.

5.2 Pricing of the basic service versions regarding cross-selling effects

The least complex situation to price the basic service through channel m and n occurs, when the maximal price for service S (based on A2b) is lower than its marginal costs k^S. Then, the FSP sets price p^S such that no customer segment consumes service S even when they learn

about it. Consequently, no cross-selling service will be sold and the results are equal to chapter 4.

In order to find the profit maximizing prices for basic service versions *m* and *n*, both cases of chapter 4 have to be analyzed regarding their impact on the expected demand and profit of service *S*.

5.2.1 Case 1 with cross-selling aspects: Both segments are directed to channel j

Based on (3), the profit now including the cross-selling service could be computed as:

$$p = (t_1 + t_2) \cdot \left(N - \max(c_1^j; c_2^j) - k^j\right) + x_1^j \left(t_1^S + t_2^S\right) \cdot \left(p^S - k^S\right) - \overline{K} \qquad \textbf{(17)}$$

The optimal price for the basic service $N - \max(c_1^j; c_2^j)$ in the optimal channel does not change considering cross-selling aspects, since it is only influenced by the utility and customer's costs for the basic service. But what could change is the decision, which channel is optimal for the overall profit, because of different cross-selling probabilities in the channels. We want to figure out, under which circumstances it is more profitable to direct both segments to channel *j* instead of channel *k* (with $j,k \in \{1,2\} \wedge j \neq k$). Therefore, we compute the difference of overall profits between directing both segments to these channels, considering cross-selling-implications. Thereby, we can derive the profit-maximizing-condition (PMC) for channel *j*:

$$\begin{aligned} p_\Delta = p\left(p^j \mid j=1\right) - p\left(p^j \mid j=2\right) > 0 \quad \Leftrightarrow \quad & \underbrace{(t_1 + t_2)}_{c} \cdot \left(\underbrace{k^k - k^j}_{a} + \underbrace{\max\left(c_1^k; c_2^k\right) - \max\left(c_1^j; c_2^j\right)}_{b} \right) + \\ + \underbrace{\left(t_1^S + t_2^S\right)}_{d} \cdot \underbrace{\left(p^S - k^S\right)}_{e} \cdot \underbrace{\left(x^j - x^k\right)}_{f} > 0 \quad \Big| \quad & j,k \in \{1,2\}, j \neq k \end{aligned} \qquad \textbf{(18)}$$

Whether this new PMC holds for channel *j* does now not only depend on cost difference (part a) and the price difference (part b) of the two channels, but also from cross-selling. If the "old" PMC (chapter 4) was true without cross-selling, it is obvious that *j* stays the optimal

channel since cross-selling is easier ($x^j > x^k$) through it than through channel *k*: the parts d, e and f of the PMC are positive, i.e. a higher profit with service *S* is achieved when all customers use channel j instead of channel k. The situation becomes more complex if the cross-selling probability is larger in channel *k* ($x^j < x^k$). A **marginal** profit advantage (a + b) for the basic service when all customers use channel *j* is now not sufficient anymore to prefer channel *j* over channel k. Using channel j instead of channel k regarding cross-selling effects induces a loss in the **marginal** ($e \cdot f$) **and also total** profitability of service S (f and therefore $d \cdot e \cdot f$ are negative). Thus, channel j is only optimal for the basic service when the **total** profit advantage for the basic service in favor of channel *j* exceeds the total disadvantage of channel j for cross-selling service *S*. In contrast to a previous decision in favor of channel *j* without consideration of cross-selling aspects, channel k is now optimal if the profit advantage for the basic service in favor of channel j is outnumbered by a profit disadvantage of channel j for the cross-selling service.

5.2.2 Case 2 with cross-selling aspects: Customer segments are directed to different channels

The overall profit including the cross-selling service *S* could be computed as:[10]

$$p = t_1 \cdot \left(N - c_1^m + \min(0; c_1^n - c_2^n) - k^m\right) + t_2 \cdot \left(N - c_2^n + \min(0; c_2^m - c_1^m) - k^n\right) + \\ + \left(x_1^m \cdot t_1^S + x_2^n \cdot t_2^S\right) \cdot \left(p^S - k^S\right) - \overline{K} \qquad \textbf{(19)}$$

Since the CEC is only a result of the customer's net utility for basic services and their channel choice, it is identical to chapter 4.2. The cross-selling service does not influence their decisions, because it is unknown to them at the beginning. Thus, the cross-selling of service *S*

[10] As in case 1, the pricing of the basic services is not influenced by the cross-selling service.

only has an influence on the overall profit, but not on the pricing of the basic service versions in this case.

5.3 Results

To sum up, the joint optimization of the overall profit has neither an influence on the pricing of the basic service versions, nor on the pricing of the cross-selling service. Furthermore in case 2, the channel choice does not change compared to the situation without cross-selling, as it is exactly determined by the CEC. Thus, even if the FSP would like to redirect the customer segments to another channel – which might be reasonable because of cross-selling aspects –, this is not possible.

However in case 1, a possible cross-selling advantage in favor of channel *m* changes this decision, when it outnumbers a possible profit advantage in the basic service versions in favor of channel *n* and vice versa.

Comparing the overall profits of the optimal pricing decision in case 1 and 2 with and without consideration of cross-selling aspects, the FSP will set the prices such that the case with the highest overall profit will be realized. The optimal decision does not necessarily need to change considering cross-selling aspects.

6 Implications

Regarding the question whether customers can be directed to a specific channel by pricing the basic services, it has been shown that the FSP can either direct all customers to one channel or distribute them over several channels. In the first case, the FSP can direct the customers to the desired channel according to his cost structure. With the help of the PMC, the most profitable channel can be determined easily. However in the second case, there is no channel choice as the CEC defines exactly, which customers can be directed to which channel. Since a decision

rule, which case should be considered by the FSP, could not be concluded analytically from the model, this has to be decided in each situation by comparing the profits of both cases. Consequently, the pricing of the channel versioned services directs the customers and has therefore a significant influence on the FSP's profits.

Based on these findings, we can determine the profit maximizing prices of the basic services in each case as a result of the model. Thereby, the results only depend on the customers' costs of using a channel, and consequently, certain situations might induce even negative prices for one channel versioned service. Without considering cross-selling aspects, this leads to the conclusion that in a mid- to long-term perspective this loss-inducing service should be abandoned, unless it is such a basic service (e.g. a remittance) that constitutes the nature of the FSP.

Generally speaking, we can conclude that if case 1 is more profitable, the other channel should be closed down in order to save fixed costs. Thus, cannibalization between the channel versioned basic services seems to be possible.

However, regardless of case 1 or 2, certain customer cost situations might lead to negative profits. Thus, if there is no cross-selling, the FSP should be closed down.

As shown, cross-selling services do not influence the price setting of the basic services. However, cross-selling might change channel decisions (in case 1) and make negative prices reasonable, even in a long-term perspective. I.e. it could be optimal to offer a basic service at a price lower than its marginal costs (negative margins) in order to establish cross-selling opportunities. In practice for example, these findings might also justify the charge-free offering of basic services like research information of many FSPs. Equally, the unprofitable pricing (i.e. the setting of negative prices) of payment transactions of German HypoVereinsbank – mentioned in chapter 2 - can be understood considering the results of the presented model. Generally, FSPs hope to establish customer relationships through the well

known basic service in order to cross-sell unknown services using the various contact points (channels) to the customer.

The findings of the model can be clarified in a simple example based on the following figures:

Variables:

$N_{basic\ service}$:	10 units	$N_{cross\text{-}selling\ service}$:	300 units

Customer segment 1:

c^1:	2 money units
c^2:	12 money units
t:	50
t^S:	30
c^S:	7 money units

Customer segment 2:

c^1:	6 money units
c^2:	12 money units
t:	70
t^S:	40
c^S:	7 money units

FSP:

k^1:	3 money units
k^2:	1 money units
k^S:	5 money units

K^1:	100 money units
K^2:	50 money units
$\overline{K}$:	150 money units

Cross-selling probabilities:

x^1:	10%	x^2:	13%

Thereby, channel 1 is a brick-and-mortar branch with high fixed annual costs, and channel 2 represents the Internet. The basic service may be a remittance that does not generate a high utility (10) to the customers. However, the cross-selling service, a standardized life insurance, constitutes a value-added service to both customer segments and generates a high margin for the FSP.

Without considering cross-selling, the FSP will set optimal prices $p^1 = 4$ for the remittance in the branch and $p^2 = -1{,}99$, i.e. the payment of 1,99 money units per transaction through the Internet to a customer. Despite this price setting, the cost structure of both customer

segments induces them to use the branch office in this situation, where a profit of 20 money units is generated. The Internet is not used, and therefore there exists a negative profit of -50 (i.e. the fixed annual costs), which leads to a negative overall profit of -30. In this case, it might be reasonable to close down the Internet (or not to establish it at all), as the fixed annual costs could be saved.

If cross-selling is considered in the profit-maximizing pricing decision, the prices change to $p^1 = 8$ and $p^2 = -2$. The additional cross-selling service is priced with $p^S = 293$. As the price for using the branch has doubled, the customer segments can now be directed to different channels: Segment 1 remains in channel 1 (the branch office) since its net utility of using the branch is non-negative and that of the Internet negative. However, the net utility of segment 2 for using the branch is now negative and zero for using the Internet. Therefore, this segment changes its channel choice to the Internet.

The profit situation changes dramatically: considering only the basic services, the overall loss is even bigger (-110) than in the previous situation, but through cross-selling, an overall profit of 2151,6 can be generated. Concluding, it can be stated that even if prices are optimised only with regard to the basic services, cross-selling will create a positive profit of 1886.

However, the example shows clearly that the FSP should consider cross-selling opportunities when maximizing its profit since the overall profit increases from 1886 to 2151,6, which represents 12%. Obviously, multi-channel pricing is an effective instrument for a FSP to optimise the overall profit, but for achieving optimal results, all services and channels have to be considered. The isolated profit maximization of basic services leads only to sub optimal overall profits.

7 Limitations and Outlook

In this paper we introduced the idea of channel versioned products and, at the first time, a (simple) model for multi-channel pricing was set up. Although we had to introduce rather strict assumptions, like the reduction to two channels and two customer segments and only a simplified way of cross-selling, we were able to deduct some very useful results:

- It could be shown that the introduction of additional channels might - but not necessarily – be positive for the FSP as well as for the customers.
- Moreover, the basic hypothesis of this paper that multi-channel pricing is useful and increases the FSP's profits, could be proofed.
- Some rather non-intuitive effects of reality, like negative prices for remittances at German HypoVereinsbank or the provision of free research for customers could be explained within the model.
- Finally, decision rules were deducted to determine the channel versioned prices and the channel choice of the customers.

However, so far only basic questions of multi-channel pricing were investigated. But these results are the general basis for further research:

- The simplification of 2 channels and 2 segments should be offset in further analysis.
- So far, a monopolistic situation was analyzed, where the FSP could set prices without respect to competitors. The introduction of an oligopolistic competition will surely provide deeper insight in the structure of markets, in which multi-channel situations are prevailing.
- From a FSP's point of view, the customers' decision, which FSP to choose, seems to be very relevant. This aspect is especially important with regard to the acquisition of new customers. But since the customers' provider decision is not only based on one,

but on a set of services, the bundling of services and its pricing should be considered as well.

- Yet, the question of welfare has not been investigated. Although it has been shown that several channels might offer the possibility to extract consumer surplus by the FSP, an analysis of the welfare of the economy might be rewarding.

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