Single- versus Multi-Channel Distribution Strategies in the German Life Insurance Market

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Abstract

Until its liberalization in 1994, exclusive agents dominated the distribution of insurance products in the German insurance industry. Since then, their importance has been declining, which has benefitted distribution via direct distribution and independent agents. However, the market shares of specialized direct and independent agent insurers remain small, while multi-channel insurers increasingly incorporate direct and independent distribution channels, and represent the dominant distribution strategy.

The paper analyzes the performance of single and multi-channel distribution firms in the German life insurance industry in order to explain the development and the coexistence of the distribution systems. Our study contributes to research on the coexistence of distribution system in the insurance industry, which has thus far been limited to comparing exclusive versus independent agent insurers.

Applying an empirical framework developed by Berger et al. (1997), we estimate cost and profit efficiency for three groups of life insurers, each with different distribution systems: multi-channel insurers, direct insurers, and independent agent insurers. Non-parametric DEA is used to estimate efficiencies for a sample of German life insurers for the years 1997-2005. Testing a set of hypotheses, we find economic evidence for the coexistence of different distribution systems: the absence of comparative performance advantages of specialized insurers.

Keywords: insurance markets, distribution systems, efficiency analysis, DEA

JEL-Classification: G 22, L 15, L 22

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1 Introduction

Following the liberalization of the European insurance markets in 1994, German insurance markets were deregulated. This has allowed insurance companies to choose their prices (premium levels) freely, which has led to increasing price competition in the German insurance sector. In addition, insurers are no longer required to acquire authorization for the design of their products from the regulatory agency, which has led to a greater variety of products in the market. Both effects are intensified by the introduction of the European Single Market, which has enabled European insurance firms to operate throughout the EU under a single license. Further, new insurance products have been created as a result of the German government’s promotion of the private old-age provision.

These developments were supposed to have a strong impact on the structure of the distribution systems of German life insurance firms, which had been dominated by exclusive, firm-owned agents. The increased price competition was expected to lead to a rise of lower-cost direct distribution channels (e.g., Muth, 1993), backed by technological progress, which permits selling of insurance products via the internet (e.g., Cattani et al., 2004). The increased product variety has also led to the hypothesis that distribution by independent insurance brokers would become more important in the German market, as these agents are able to compare a higher number of insurance products and so deliver higher service quality to their customers (e.g., Finsinger and Schmid, 1993). The increasing importance of the private aging provision in the German market should reinforce this development, as customers’ need for counselling, which is best met by independent agents, increases (Eckardt, 2007 and Trigo Gamarra, 2007).

Both expected changes have been reflected in the development of the German life insurance distribution since the liberalization. Direct distribution and distribution via independent agents have gained importance while distribution via exclusive agents has decreased. Specialized insurance firms using only direct distribution or independent agents show only a small increase
in their market shares, while most German life insurance firms, which have traditionally
distributed their products through dependent agents, now use a multi-channel distribution
strategy of direct, exclusive, and independent channels.

The aim of this paper is to analyze the reasons for the development of the market shares of
specialized insurers and multi-channel distribution channels in the German life insurance market
by comparing the performance of both distribution systems. According to previous studies,
specialized suppliers should be superior to multi-channel insurers if they were able to realize
either cost advantages by being direct insurers or quality advantages by distributing via
independent agents.

Methodologically, these hypotheses can be tested by analyzing the firms’ cost efficiency to
identify organizational cost advantages and profit efficiency to account for presumable quality
related price differences. For this purpose, we separate insurance companies into three groups:
multi-channel insurers which use at least two different distribution channels to distribute their
products, direct insurers which use only direct channels like the internet, mail, and telephone;
and insurers which use only independent insurance agents and brokers for the distribution of its
products. Our data set of German life insurance firms was taken from periodically published
industry reports for 1997-2005. Company-specific efficiency scores are estimated by using
efficiency-frontier estimation to compare cost and profit efficiency levels. Thereby, it is possible
to analyze multidimensional input-output technologies. The non-parametric Data Envelopment
Analysis (DEA) is employed since it does not require a priori specification of a functional form
of the production function making it a very flexible instrument concerning the modelling of the
industry’s technology (Charnes et al., 1978).

Our paper contributes to the literature on insurance organizations and market economics and on
the research on the coexistence of different distribution systems in life insurance industry in
particular, as, to our knowledge, we are the first to compare single- and multi-channel
distribution insurers. While previous research was limited to the comparison of exclusive and independent agency insurers (e.g., Berger et al., 1997 and Klumpes, 2004), our research adds a new facet to the discussion about the coexistence of different distribution channels in insurance markets.

The paper is organized as follows: section 2 provides an overview of the German life insurance industry and its distribution structure. In section 3, we present the hypotheses and give an overview of earlier studies. Section 4 illustrates the methodology and our modelling approach. In section 5, the data and the estimation model are described. Section 6 presents the results of our efficiency estimations. Conclusions are drawn in section 7.

2 Distribution channels in the German life insurance industry

A distribution system can be defined as “the network of people, institutions or agencies involved in the flow of a product to the customer, together with the informational, financial, promotional and other services associated with making the product convenient and attractive to buy and rebuy” (O’Shaughnessy, 1988). German insurers are not obligated to reveal the structure of their distribution system in detail, so detailed figures about the contribution of single distribution channels to the insurance business are not available. Even so, we can derive the structure of an insurance company’s distribution systems from its annual financial statements. Before 1994, in the German insurance industry as a whole, but especially in the life insurance sector, distribution via exclusive agents had been the dominant distribution channel. Exclusive (or tied) agents are allowed to sell only the products of specific insurance firms or groups, although these agents are usually self-employed. This distribution channel dominated because of the strict regulation of the German insurance sector before 1994, which prescribed minimum premium levels. Thus, insurers were interested in maximizing sales, which could be best achieved by a large own sales force (e.g., Finsinger and Schmidt, 1993).
In addition to exclusive agents, the majority of German life insurers also use independent insurance agents and insurance brokers to distribute their products. Both of these are free to choose the products they sell and the companies with which they work. Also, they act predominantly on behalf of the customer. A third distribution channel is the bank branch network, which had been used primarily by German public insurance companies, but is increasingly used by many private life insurance firms. Life insurers also use direct distribution channels to sell their products. Direct distribution encompasses all distribution channels in which insurance products are sold to the customer without any direct contact with a salesperson. The internet has become the main direct distribution channel, but insurance products may also be sold via telephone, television or mail.

In total, the premium income of German life insurers was distributed as follows in 2005: Exclusive agents accounted for 27.1 percent of premium income, independent agents and insurance brokers for 32.4 percent, the distribution via banks for 24.8 percent, and the distribution via direct channels for 5.5 percent (Tillinghast, 2006).\(^1\) It can be stated that the distribution via exclusive agents is decreasing. In 2002, the exclusive agents still showed a premium income share of 40 percent, while independent agents accounted for 24 percent and distribution via bank offices remained stable. However, distribution via direct channels increased from 2.2 percent in 2002 to 5.5 percent in 2005 (Tillinghast, 2004).

\(^1\) These numbers are based on a survey conducted by the international consultancy Tillinghast Towers Perrin. Fifty-one German life insurers participated in the survey, representing approx. 75 percent of the German life insurance market. Information about the missing firms was complemented by Tillinghast based on information from annual statements and their own market knowledge (Tillinghast, 2006). Premium income was measured by the Annual Premium Equivalent (APE) which represents the sum of the current premium payments and 10 percent of the single premiums in a year.
Approximately 85 percent of life insurance firms in Germany use a multi-channel approach that combines at least two channels: mainly exclusive and independent agents or insurance brokers. However, an increasing number of life insurers also incorporate direct distribution channels and distribution via bank offices into their systems. By contrast, specialized life insurance firms in the German market use only a single distribution channel. Among these, one of two single-distribution approaches is most likely: Direct insurers which exclusively distribute their products without the use of salespeople and independent agency insurers which distribute exclusively through independent agencies and insurance brokers. The number of direct insurers remained stable over the observation period with 8 direct life insurers in 1997 and 9 in 2005. As for independent agency insurers, 10 were in the market in 1997 and 9 in 2005.

Premium income by direct insurers amounted to 3.3 percent in 1997 and had increased to 4.3 percent in 2005; among independent agency insurers, the premium income was 4.5 percent in 1997 and had increased only to 5.0 percent in 2005; and the remaining premium income was generated by multi-channel-insurance firms. This shows the large dominance of multi-channel distribution compared to insurers that use specialized distribution systems.

3 Single-Channel versus Multi-Channel Distribution Systems — Hypotheses and Previous Evidence

3.1 Hypotheses

The aim of this paper is to analyze the reasons for the development of the market shares of specialized insurers and multi-channel distribution channels in the German life insurance market by comparing the performance of both distribution systems. We begin with a discussion of the theoretical advantages and disadvantages of multi-channel distribution systems and the two single-distribution channel systems, and then derive the hypotheses to be tested in this study.

Multi-channel insurers: Multiple channels allow insurance firms to extend their market coverage by employing various distribution channels (Coelho and Easingwood, 2004). The German life insurance market has an increasing number of products as a consequence of the industry’s
liberalization and an increasing demand for private old-age provisions. A multi-channel approach also allows the insurer to share knowledge and information about customers among its channels (Easingwood and Coelho, 2003). In addition, an insurer which uses multiple channels can target many different customer segments and reach new customer segments more efficiently. Chen et al. (2002) showed in a formal model that the incorporation of an online channel may increase the insurer's ability to price-discriminate between users and non-users of the channel, leading to increased profit. Moreover, the use of multi-channel distribution may be more able to meet the needs of existing customers (Tsay and Agrawal, 2004) because existing customers can purchase the firm's products via the channel that suits them, depending on the characteristics of the product and their preferences. Thus, firms with broad product lines will particularly benefit from the distribution via multiple channels (Webb, 2002). The customers may also save on search costs or transaction costs by holding a multiple-product relationship with a single insurance firm. Wallace et al. (2004) observed that a multiple channel distribution strategy serves as an instrument by which to increase customers' satisfaction and customer loyalty, which is of particular importance in an increasingly competitive environment like the liberalized German insurance market.

Finally, the use of multiple channels makes enables insurance firms to reduce risks which can specifically arise with a single-channel distribution strategy. Multi-channel insurers are better able to react to a changing environment, e.g., changing consumer preferences or increasing competition. The use of additional channels may prevent incumbents from losing market shares to new rivals which enter the market via specialized channels at low prices. Dutta et al. (1995) contended that the introduction of an additional channel may represent a safeguard against lock-in problems with existing channels and that multiple channels facilitate the firm's ability to evaluate the performance of the different channels. Kumar and Ruan (2006) found that the addition of a direct channel (an online channel or an exclusive agency channel) may help
increase the level of support from existing independent retail channels (independent agencies or brokers).

There are also potential disadvantages to the use of multiple channels by life insurers. Cost disadvantages can arise because of the high investment costs necessary to establish an additional distribution channel and to coordinate between the channels (Easingwood and Storey, 1996). The insurer also runs the risk that newly established distribution channels will not be accepted by the customers or that customers will make use of new distribution channels (e.g., direct marketing channels) only to inform themselves, while using the established channels (e.g., exclusive agents) to purchase the product. This problem is also known as channel cannibalization: instead of increasing turnover and profits, additional channels simply redirect turnover from one channel to another (e.g., Dzienziol et al., 2002).

Direct insurers: Direct-distribution insurers have the advantage that they are able to provide their services at lower costs compared to insurance firms which use agents, bank branches and other third parties to distribute their products. Cost advantages result from the absence of commission costs, which leads to lower operating expenditures. Moreover, they save the large fixed costs of establishing a distribution network through constructing their own branches or bank branches. This cost advantage allows direct insurers to offer lower premiums. A potential disadvantage of this distribution system lies in the fact that the more complex insurance products are difficult to sell without personal advice by an intermediary or staff member at a branch office. As life insurance products tend to be complex, the growth of direct life insurance firms could be limited as a result of the missing personal contact between insurance firm and customers (e.g., SwissRe, 2000). Further, insurers which enter the market must incur high marketing costs for customer acquisition and the creation of a well known brand (e.g., Ennew and Waite, 2007). By making

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2 For a formal analysis, see the model of direct banking by Neuberger (2007), which can be applied to the case of direct insurers.
use of a new technology, most direct insurers are new entrants to the market. Limited growth in a highly competitive market combined with high investments for the establishment of the firm can prevent a new entrant from realizing possible economies of scale. However, scale effects are of major importance in the insurance industry because insurers face relatively large fixed costs in computer systems and financial capital, and because the industry operates on the basis of the law of large numbers: the larger the policy portfolio of similar risks, the better the insurance firm is able to assess the risks and to lower risk volatility (e.g., Cummins and Rubio-Misas 2006).

**Independent agency insurers:** Distribution by independent agents incurs the highest costs compared to the distribution via exclusive agents, branch offices or direct distribution (e.g., Zweifel and Ghermi, 1990 and Dahmen, 2004). These higher expenses are due to differences in the property rights structure of the relationship between the insurance company and the different types of agents. In contrast to exclusive agents or branch office staff, independent agents own an individual client list and have the right to policy renewal. This means that independent agents directly contact the customer at the end of the contract period and decide which of the insurers in the agent’s portfolio will receive the renewal business. Therefore, typical independent agent renewal commissions are higher than the commission level in exclusive distribution systems, as the insurer must pay more to ensure that an independent agent acts in its interests and does not move the client to another insurer. Thus, insurers incur higher monitoring costs when dealing with independent agents (Barrese and Nelson, 1992). Insurance brokers are able to compensate for passing these higher costs along to their customers with a higher level of service quality. From the insurers’ perspective, the use of independent agents enables insurers to reduce transaction costs and to write more profitable business (Anderson et al., 1998). The lower transaction costs from independent agents occur because they face higher incentives to perform detailed risk analyses (for more details, see Regan and Tennyson, 1996 and Regan, 1997). From a customers’ point of view, the higher quality from independent agents results from a reduction
in search costs (Posey and Tennyson, 1998), a better market overview, and better monitoring of the insurer for, for example, appropriate coverages, low prices, and financial stability (Regan, 1997). Mayers and Smith (1981) and Barrese and Nelson (1992) also state that independent agents are better able to deal with insurers when there is a conflict with the policyholders, as they can threaten to move the customer to another insurer. Because of their higher costs and ability to provide higher service quality, independent agency insurers tend to focus on complex, counselling-intensive insurance products and compensate for their higher costs with higher revenues which result from higher service quality (e.g., Berger et al., 1997). A potential disadvantage of this single-distribution channel system would arise only if independent insurers were not able to realise higher average revenues.

To explain the distribution structure and the coexistence of different distribution channels in the German life insurance industry we compare the performance of two different single-distribution channels with the multi-channel distribution approach. Insurers' performance is measured in terms of both costs and profits, while the latter implicitly incorporates aspects of service quality. Thus, our approach allows an analysis of the different distribution strategies' total economic performance, as we allow higher costs to be compensated for with higher prices/revenues resulting from higher service quality.

The performance comparison is carried out by testing two sets of hypotheses. To compare direct with multi-channel insurers, we derive the following hypotheses from our theoretical considerations:

**H 1:** Direct insurers are more cost efficient than multi-channel insurers.

The second single-channel distribution strategy - independent insurers - are compared to multi-channel insurers by testing the following two hypotheses:

**H 2.1:** Compared to multi-channel insurers, independent agency insurers are less cost efficient because of the higher costs of the independent agency system.
H 2.2: The disadvantage in terms of cost efficiency is recouped by higher revenues resulting from high service quality, which leads to similar or higher levels of profit efficiency for independent agency insurers.

If we find evidence for the presented hypotheses, specialized single-distribution strategies will be superior to broader multi-channel distribution systems; by focussing either on a cost or on a service-quality advantage, direct and independent agency insurers would outperform multi-channel distribution insurers. By contrast, if we must reject both hypotheses, the advantages of a multi-channel distribution system outweigh its disadvantages; a broad multi-distribution strategy would then be superior to single-channel distribution strategies and would explain why specialized single-distribution channel insurers have not gained a larger market share.

3.2 Previous evidence

The coexistence of different distribution systems has been the subject of several empirical studies. However, most of these studies focus on the comparison of exclusive agency insurers versus independent agency insurers. Joskow (1973) found that American insurers working with independent agents incur much higher costs than insurers using exclusive agents. Cummins and Vanderhei (1979) and Barrese and Nelson (1992) also found support for higher underwriting costs of independent agency insurers. However, none of these three studies compared the (average) profit levels of both systems. Barrese, Doerpinghaus, and Nelson (1995) incorporated a quality dimension into their analysis by using private passenger automobile insurance complaint data as a proxy for service quality. According to their study, American independent agency insurers in the private passenger automobile insurance line provide higher service quality compared to exclusive agency insurers. Berger et al. (1997) analyzed a sample of 472 U.S. insurers and concluded that exclusive agency insurers are more cost efficient, but this performance advantage disappears when revenues are taken into account. Brockett et al. (2005) also found that U.S. property-liability independent agent insurers were more revenue efficient...
than a second group of exclusive-agent and direct insurers. Finally, Klumpes (2004) analyzed a sample of U.K. life insurance firms and estimated cost and profit efficiency levels. In contrast to Berger et al. (1997) he found that independent agency insurers were both less cost-efficient and less profit-efficient compared to dependent agency insurers. However, only Cummins (1999) has included direct insurers in his analysis of the performance of different distribution systems in the U.S. life insurance industry for the period 1988-1995 and found that, compared to agent-based insurers, direct insurers had less cost efficiency and revenue efficiency, but higher technical efficiency. No study has yet compared the performance of single- and multi-channel insurers.

4 Methodology

4.1 Frontier efficiency concepts

We apply modern frontier efficiency analysis to estimate cost and profit efficiency in the German life insurance industry. The methodology allows for the analysis of multiple input-output technologies. The performance of each firm is measured by comparing it to the efficient frontier of the industry, which is composed of the efficient firms in the reference set (e.g., the industry). Thus, one can obtain firm-specific efficiency measures relative to a “best practice” frontier.

Taking into account input price information, it is possible to determine a firm’s cost efficiency (CE); a firm is fully cost efficient if it is able to produce a given output $y_0$ at minimum costs. If the production possibility set is defined as $T = \{(x,y): x \text{ can produce } y\}$, where $x$ and $y$ represent input and output vectors and the corresponding input requirement set for the given output $y_0$ is defined as $V(y_0) = \{(x: x \text{ can produce } y_0)\}$, then the cost-minimization problem of the firm can be expressed as

$$\min C = \min w'x \text{ subject to } x \in V(y_0)$$

(1)

where $w' = (w_1, w_2, \ldots, w_n)$, representing a vector of input prices.
The firm is assumed to take input prices as given; thus, it minimizes its costs by adjusting the input quantities. The CE of a firm is defined by the ratio of minimum costs to actual costs for a given output vector ranging from 0 to 1, with a score of 1 representing a fully cost-efficient firm. CE displays the product of allocative efficiency (AE) and technical efficiency (TE); thus, a firm can be cost-efficient only if it is both allocatively and technically efficient (e.g., Ray, 2004). Cost efficiency may be determined under the assumption of constant returns to scale (CRS) or variable returns to scale (VRS): CRS assume that all firms are operating at optimal scale, i.e. under minimum average costs. Under VRS, firms may exhibit increasing or decreasing returns to scale; possible (dis-)economies of scale are taken into account when calculating CE, therefore. A firm's scale efficiency (SE) is calculated by dividing the CRS efficiency score by the VRS efficiency score. It determines the amount by which a firm's efficiency could be improved by moving to its optimal scale (e.g., Coelli et al., 2005 and Ray, 2004). Fare and Grosskopf (1985) showed that SE can be determined in line with CE, given that all firms face identical input prices.

If output quantities are also regarded as choice variables, profit efficiency (PE) can be calculated. Therefore, information about both input and output prices are needed. The firm's objective is to choose the profit-maximizing input and output quantities, given the input and output prices, so it faces the constraint that the chosen input-output combination must represent a feasible production plan. The profit-maximizing problem of a firm can be expressed by:

\[
\max \Pi = p'y - w'x \text{ subject to } (x, y) \in T
\]

(2)

where \(p' = (p_1, p_2, \ldots p_m)\), representing the vector of output prices.

PE is then defined as the ratio between a firm's actual profits and the maximum attainable profits, given input and output prices. A fully profit efficient firm shows a PE score of 1. Just as
profits can be negative, profit efficiency is not bounded by 0 at the lower end, but can turn negative (zero) if profits are negative (zero).

4.1 Estimation Methodology

We estimate firm-specific efficiency using non-parametric Data Envelopment Analysis (DEA). Using DEA, an a priori specification of the underlying production function is not needed because the efficient best practice frontier is estimated by solving linear programming models to envelope the observed data as tightly as possible (Charnes et al., 1978). It requires only convexity of the production possibility set and disposability of the inputs and outputs. This makes DEA especially useful when dealing with service industries, as knowledge about the sector's production technology is usually limited (Fecher et al., 1993).

Standard CE is estimated as follows: Using data on N inputs and M outputs for each of the I firms, the i-th firm uses an N x 1 input vector $x_i = (x_{1i}, x_{2i}, \ldots, x_{ni}) \in \mathbb{R}^n$, to produce an M x 1 output vector $y_i = (y_{1i}, y_{2i}, \ldots, y_{mi}) \in \mathbb{R}^m$, where $X$ is an N x I input matrix and $Y$ a M x I output matrix that represent data for all I sample firms. First, the following linear programming problem (LP) is solved:

\[ \begin{align*}
& \text{maximize } \sum_{i=1}^{I} \lambda_i y_{1i} \\
& \text{subject to } \sum_{i=1}^{I} \lambda_i x_{1i} \leq 1, \quad \sum_{i=1}^{I} \lambda_i x_{2i} \leq 1, \quad \ldots, \quad \sum_{i=1}^{I} \lambda_i x_{ni} \leq 1, \\
& \quad \sum_{i=1}^{I} \lambda_i y_{1i} \geq 1, \quad \sum_{i=1}^{I} \lambda_i y_{2i} \geq 1, \quad \ldots, \quad \sum_{i=1}^{I} \lambda_i y_{mi} \geq 1, \\
& \quad \lambda_i \geq 0, \quad i = 1, 2, \ldots, I.
\end{align*} \]

3 A variety of solutions for the problem of negative profit efficiency has been developed: Some authors (e.g., Banker/Maindiratta, 1988) have suggested eliminating firms which exhibit negative profits before calculating efficiency scores. Others (e.g., De Young and Hasan, 1998) have added a small positive number to a firm's actual profits (losses) to ensure profits which at least equal zero. We decided not to remove firms from the sample which exhibit negative profits, as it is possible that firms incur short-term losses but are able to establish themselves in the market in the long run. This is especially true for young firms which incur high initial investments. Our sample contains a number of firms which entered the market after the liberalization of the German insurance market in 1994. We did not add a small positive number to negative profits, as we are not so much interested in the PE scores of single firms as in the average PE for different groups of insurers. As we only found very few firms showing only small negative PE scores with none of these firms showing negative PE scores over the whole observation period, the impact on the average PE efficiency scores is rather small.
\[
\begin{align*}
\min_{\lambda, x_i} & \quad w_i' x_i^* \\
\text{subject to} & \quad Y\lambda \geq y_i \\
& \quad X \leq x_i^* \\
& \quad \lambda \geq 0 
\end{align*}
\]

Further, \( w_i \) is an \( N \times 1 \) input price vector for the \( i^{th} \) firm, which corresponds to the input vector \( x_i \), and \( x_i^* \) is the cost-minimizing input vector for the \( i^{th} \) firm, which is obtained by the LP (e.g., Färe et al., 1994). Second, the CE of the \( i^{th} \) firm is calculated as the ratio of minimum cost to observed cost:

\[
CE = \frac{w_i' x_i^*}{w_i' x_i}
\]

The measure of CE is bounded between 0 and 1. A CE of 1 represents a fully cost-efficient firm; 1-CE represents the amount by which the firm could reduce its costs and still produce at least the same amount of output.

The presented LP approach calculates CE under the assumption of CRS (\( CE^{CRS} \)). To calculate CE under VRS (\( CE^{VRS} \)), the convexity constraint \( I_1' \lambda = 1 \) is added, where \( I_1 \) is an \( I \times 1 \) vector of ones (Banker et al., 1984).

In the insurance sector, input and output quantities are typically reported using a monetary dimension. Further, the definition and calculation of input and output prices is rather difficult and the subject of controversy in the literature. Therefore, we follow Tone (2002) and Cooper et al. (2006) and calculate CE by replacing the input vector \( x_i = (x_1, x_2, \ldots, x_n) \in \mathbb{R}^n_+ \) in the above LP by a vector \( \bar{x}_i = (\bar{x}_1, \bar{x}_2, \ldots, \bar{x}_n) \in \mathbb{R}^n_+ \) with \( \bar{x}_i = (\bar{x}_1, \bar{x}_2, \ldots, \bar{x}_n) \), representing the monetary input.
quantities, i.e., costs. This approach further allows us to model input prices $w_i$ as equal to unity for all selected inputs.\footnote{This approach was already suggested by Färe and Grosskopf (1994), who showed that cost efficiency can be determined using DEA by minimizing costs, given output quantities, without differentiating between input quantities and input prices. Tone (2002) and Cooper et al. (2006) called a comparable approach new cost efficiency. Their focus differs from ours, as they accounted for different input prices faced by the firms by considering $x_i$. In our opinion, this approach may also be used if input prices are not or only partially available, but if information about costs is present, as in our case. The resulting efficiency scores contain both technical and allocative inefficiencies, as the firm’s decision about the optimal use of input factors, depending on the given input prices, is already contained in the cost information. The fact that allocative and technical inefficiencies cannot be differentiated does not represent a major shortcoming here, as the differentiation between them is of only minor importance for the purpose of our study.}

In a second step, profit efficiency is estimated. The profit maximization LP is solved as follows:

$$\begin{align*}
\max_{\lambda, y_1^*, x_1^*} & \quad p_i' y_1^* - w_i' x_1^* \\
\text{subject to} & \quad Y\lambda \geq y_1^* \\
& \quad X \leq x_1^* \\
& \quad I'\lambda = 1
\end{align*}$$

Further, $p_i$ is an $M \times 1$ vector of output prices for the $i$th firm, and $y_1^*$ is the revenue-maximizing vector of output quantities for the $i$th firm. Given input and output prices, $x_i^*$ and $y_1^*$ are calculated by the LP (e.g., Zhu, 2003 and Ray, 2004). A measure of PE can be obtained by calculating the ratio of observed profit to maximum (potential) profit.

$$PE = \frac{p_i' y - w_i' x_i}{p_i' y^* - w_i' x_i^*},$$

\footnote{This approach was already suggested by Färe and Grosskopf (1994), who showed that cost efficiency can be determined using DEA by minimizing costs, given output quantities, without differentiating between input quantities and input prices. Tone (2002) and Cooper et al. (2006) called a comparable approach new cost efficiency. Their focus differs from ours, as they accounted for different input prices faced by the firms by considering $x_i$. In our opinion, this approach may also be used if input prices are not or only partially available, but if information about costs is present, as in our case. The resulting efficiency scores contain both technical and allocative inefficiencies, as the firm’s decision about the optimal use of input factors, depending on the given input prices, is already contained in the cost information. The fact that allocative and technical inefficiencies cannot be differentiated does not represent a major shortcoming here, as the differentiation between them is of only minor importance for the purpose of our study.}
so that \(-\infty \leq \text{PE} \leq 1\) describes the maximum amount by which the profits of an inefficient firm could be increased before it achieves full profit efficiency. \(\text{PE}\) is estimated under the assumption of VRS \((\text{PE}^{\text{VRS}})\) because, under the assumption of CRS, maximum profit would be zero or undefined (e.g., Ray, 2004 and Färe et al., 1994).

Again, we follow Cooper et al (2006) and calculate the "new" profit efficiency, since data about output prices is not available but information about revenues, which represent the product of output quantities and prices, is available (see section 5 for a more detailed discussion). For this calculation, the output vector \(y = (y_1, y_2, \ldots, y_m) \in \mathbb{R}^m^+\) is replaced by the vector \(\bar{y}_i = (\bar{y}_1, \bar{y}_2, \ldots, \bar{y}_m) \in \mathbb{R}^m^+\), where \(\bar{y}_i\) represents the revenues of firm \(i\). This allows us to model output prices which equal 1. Also, the input vector \(x_i = (x_1, x_2, \ldots, x_n) \in \mathbb{R}^n^+\) is replaced by a vector \(\tilde{x}_i = (\tilde{x}_1, \tilde{x}_2, \ldots, \tilde{x}_n) \in \mathbb{R}^n^+\), where \(\tilde{x}_i = (\tilde{x}_1, \tilde{x}_2, \ldots, \tilde{x}_n)\), representing the monetary input quantities, i.e., the costs. Finally, input prices are assumed to equal 1.

5 Dataset and Variables

5.1 Dataset

In 2005, the German life insurance market ranked fifth in the world and fourth in Europe in premiums with a volume of 72,600m €. Total invested assets in the German life insurance industry were 642,812m € in 2005, representing 27.6 percent of the GDP. German life insurance premium income represents 48 percent of total premium income in the German insurance industry (GDV, 2006) and 3.06 percent of GDP. The number of life insurance firms active in the German market declined slightly during our observation period, from 119 in 1997 to 115 in 2005 (Bafin, 2006) Most of the reduction can be explained by mergers and acquisitions as a consequence of the liberalization of the German insurance market in 1994. The data used in this study are taken from periodically published insurance industry reports and insurers' income statements for the years 1997-2005 (Hoppenstedt 1999-2007). However, Hoppenstedt registers
every licensed insurance firm in Germany, so the database contains also information about firms that do not actively participate in the insurance market. We eliminated firms which had not delivered any information at all, or which showed negative observations for inputs or outputs. In addition, we removed firms operating only in very specialized product niches, offering products only to a very specialized customer base (e.g., civil servants, doctors) or offering only single, specialized insurance products (e.g., exclusively term-life insurance). These firms were eliminated as they are not representative of the industry as a whole. In the end, our data set accounts for approximately 90 percent of the total premium income of the industry.

The German life insurance industry is characterized by a large heterogeneity among the firms, so we corrected for outliers in the sample by applying the outlier correction model suggested by Wilson (1993). We found that, in each year, the firms detected as outliers were among the largest in the sample.5

5.2 Variables

Using DEA requires identifying the relevant inputs and outputs of an insurance firm. However, a review of the literature does not show clear consensus on a single input/output specification. This study uses the value-added approach which is common in the literature (e.g., Cummins and Weiss, 2000). In using this approach, the services provided by insurers are defined before suitable output proxies are chosen. These services can be split up in three major groups: risk-bearing/risk-pooling services, “real” financial services related to insured losses, and intermediation services. Following the value-added approach, then, the output of a life insurance company is defined in our study as follows:

5 The results of the efficiency estimations differ only slightly if the detected outliers are not excluded from the sample, though, and all of the qualitative results of the study remain unchanged.
We approximate the risk-bearing function by using *incurred benefits net of reinsurance*. Incurred benefits represent payments received by policyholders in the current year. They can be seen as proxies for the risk-bearing/risk-pooling function because they measure the amount of funds distributed to the policyholders as compensation for incurred losses. The funds received by insurers that are not needed for benefit payments and expenses are added to policyholder reserves. Thus, *additions to reserves* is a suitable proxy for the intermediation function of the insurer. Finally, we include *bonuses and rebates* into our output measure because these funds benefit the policyholders. By choosing incurred benefits net of reinsurance and the additions to reserves as output proxies, we follow the majority of the life insurance studies (e.g., Meador et al., 1997; Cummins and Zi, 1998; Cummins et al., 1999; Fenn et al., 2008). All three output measures are correlated with real services provided by life insurers. Because of limited data availability, it is not possible to split up the output measures provided by the life insurance firms according to the different insurance lines.

Life insurers' revenue is measured by the *sum of premium and investment income* (e.g., Cummins and Weiss, 2000 and Fenn et al., 2008). Premium income is measured by the sum of gross written premiums, less ceded reinsurance premiums, less the change in the provision for unearned premiums.

Insurers' inputs can be classified into three principal groups: labor, business services and materials, and capital. In most cases, physical measures for these inputs (e.g., the number of employees) are not available, but there is information about the costs an insurance firm incurs for their use. They are already valued by the corresponding input prices, so they represent the product of input quantities and prices. Using the new-cost/new-profit efficiency approach

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4 We tested for the influence of the output measure bonuses and rebates by leaving this measure out and re-estimating cost and profit efficiency levels. Our results proved to be robust and did not differ significantly between both models.
suggested by Tone (2002) and Cooper et al. (2006) allows us to take cost measures into account directly. Most studies derive input quantities by dividing cost values by a uniform price/wage index over all firms. Compared to our approach, this leads to the same CE values (see Fare and Grosskopf, 1985). Technically, input prices are set to 1 by convention (e.g., Mountain, 1999, and Paradi, 2006).

To measure insurers' costs, we choose acquisition and administration expenses, which sum up to equal operating expenses, as a proxy for the insurers' inputs for labor and business services (e.g., Cummins and Zi, 1998 and Berger et al., 1997), since administration and acquisition expenses contain the insurers' expenses for labor and business services.

The consideration of financial capital is also important in the case of insurance firms. Insurance studies frequently use financial equity capital but seldom use financial debt. Equity capital is used as an input because insurance is viewed as risky debt (e.g., Cummins and Danzon, 1997). According to this approach, insurance premiums are discounted in the market to account for the insurer's default risk. This study follows the majority of extant insurance studies by using statutory policyholders' surplus as a consideration for financial equity capital. To measure the cost of equity, financial equity capital should be valued by the firm-specific price for equity capital (for an overview of the different approaches to measure cost of equity capital see Cummins and Weiss, 2000). Because of limited data availability and the small influence of the different approaches on the efficiency results found in other studies, we modify an approach by Cummins and Rubio-Misas (2006), who assume identical capital costs over all firms, and set prices for equity capital to 1.

7 Some studies also include physical capital as an input measure (e.g., Meador et al., 1997) but, in general, the amount of physical capital used by insurance firms is rather small. We checked for the influence of physical capital by including capital expenses into our analysis, but it had little influence on our results. To avoid an unnecessary increase in the number of variables used in our analysis, then, capital expenses were left out of the analysis.
Summarizing, we measure insurers' output by the sum of incurred benefits net of reinsurance, additions to reserves, and bonuses and rebates. Costs are measured by the sum of acquisition and administration expenses, and equity capital. Revenues are the sum of net premium income and investment income. Table 1 presents summary statistics for the variables used in the analysis as described above as mean values for the whole observation period.

[Table 1 about here]

The descriptive statistics show a large dispersion for all the variables between the smallest and largest firms in the sample, as well as among the three analyzed groups of insurers. Direct insurers show the smallest average values in terms of operating expenses, outputs, and revenues in the sample. In terms of equity capital, independent agency insurers show a slightly lower value compared to direct insurers. In general, independent agency insurers show higher cost, output and revenue levels. The largest group of firms is the multi-channel insurers, which show a 3.87 times larger output, compared to the direct insurers, and 3.20 times larger output compared to independent agency insurers. The differences between these groups are also apparent in terms of costs and revenues.

6 Results

Tables 2 and 3 report the results of the comparison of average CE, SE, and PE scores for the three different groups of insurers we analyzed. To compare the mean efficiency scores of different subgroups in the sample, we employ the nonparametric Mann-Whitney-U test.8 We start with the comparison of direct and multi-channel insurers before turning to the independent agency insurers.

8Traditional parametric statistics (e.g., t-tests) are not applicable for comparisons of mean efficiency scores (Brockett and Golany, 1994 and Siegel, 1997). Nonparametric estimations, e.g. DEA, make no assumptions about functional form and distribution, so the resulting efficiency scores do not meet the requirements, primarily the assumption of standard normal distribution, for these types of tests (e.g., Greene, 2003).
Surprisingly enough, direct insurers show lower cost efficiency ($CE^{CRS}$) levels compared to multi-channel insurers. The differences between both groups are significant until the year 2000. The analysis of $CE^{VRS}$ shows that the differences in CE between the groups disappear: at the end of the observation period, direct insurers even show slightly higher efficiency scores compared to multi-channel insurers. Hence, direct insurers show much lower SE levels in most years, i.e. have not reached their optimal size.

From our results, we conclude that hypothesis H 1 has to be rejected: Direct insurers do not show the expected cost advantage compared to multi-channel insurers. This seems to be due to their low scale efficiency, which does not permit them to realize their cost advantages. Although direct insurers are able to recoup some of their cost inefficiencies / cost disadvantages over time, one might assume that they have not yet reached a sufficient firm size to realize their theoretical cost advantages compared to multi-channel insurers. Differences in profit efficiency ($PE^{VRS}$) between both groups are rather small and insignificant, as the relationship between both groups in terms of $CE^{VRS}$ translates into PE. Thus, there seem to be no systematic differences in the service quality of both groups.

We explain the limited growth of direct insurers as resulting from two factors. First, the nature of life insurance products is complex, so life insurance products are regarded as comparatively counselling-intensive products. Since direct insurers do not provide their customers with personal advice, customers could rather rely on multi-channel insurers for life insurance products and use direct insurers primarily for the purchase of more standardized products. In the case of life insurance products, term life insurance is an example of a more standardized, less complex insurance product. Actually, our data set shows that the share of term life insurance policies in direct insurers' portfolios is larger, on average, compared to multi-channel insurers' portfolios.
Further, a direct insurer has been the market leader for term life insurance products since 1994 (AMB Generali, 2006). A second reason for the limited growth of direct insurers could be that multi-channel insurers are increasingly adopting direct distribution as an additional distribution channel. Thus, customers who are willing to use direct distribution channels do not necessarily need to switch to a direct insurer (Krah, 2006). This underscores the importance of reputation in insurance markets; because insurance products are credence or trust goods and direct insurers are mainly young firms which were founded after the liberalization of the market. In contrast to established multi-channel insurers, they have not been able to build up a long-term reputation. Thus, customers could prefer to use additional channels of an established multi-channel insurer instead of switching to a direct insurer (Ennew and Waite, 2007).

The comparison of multi-channel insurers and independent-agency insurers shows that independent-agency insurers have significantly lower CE over the whole observation period, under both CRS and VRS assumptions. This could be expected according to the theoretical considerations presented in section 2, as distribution via independent agents incurs higher costs. Thus, hypothesis H 2.1 cannot be rejected. Concerning SE, independent agency insurers also show lower scores compared to multi-channel insurers, but the differences are much smaller than they are in the case of direct insurers, and they are significant only for some years within the observation period.

With regard to PE, agent-based insurers are not able to recoup their disadvantage in terms of cost inefficiency, so they show lower average PE scores over the whole observation period and, from 2000 on, the differences are statistically significant. Thus, we have to reject H 2.2: Compared to multi-channel insurers, independent agency insurers are not able to recoup their higher costs by corresponding higher revenues, which would lead to similar PE levels between either group or even higher profit efficiency levels of independent agency insurers. However, this result does not imply that independent agency insurers would not be able to provide their customers with higher
service quality; it states only that the specialized distribution system of independent agency insurers is not superior, neither in terms of costs nor in terms of average revenues, to distribution via multiple channels. The differences in profit efficiency between both groups have increased since the beginning of the observation period, which could indicate that independent-agency insurers have lost part of their customer base over time because of the increasing importance of distribution by independent agents for multi-channel insurers. Thus, insurance customers who want to make use of the services of independent agents are no longer limited to the product range of insurance firms that work exclusively with independent agents but increasingly have the opportunity to purchase products from multi-channel insurers.

Our analysis shows that specialized single-channel distribution insurers are not superior to multi-channel insurers. The results give evidence that direct insurers are not able to realize their expected cost advantage over multi-channel insurers. Also, independent-agency insurers are unable to take advantage of their hypothesized service superiority. Thus, the distribution of life insurance products via multiple channels seems to be superior to specialized single-distribution channels, as none of the specialized insurers shows a comparative performance advantage.

7 Conclusions

Our analysis of the performance of single-channel distribution and multi-channel distribution firms in the German life insurance helps to explain the structure of the industries' distribution systems, where the distribution of life insurance products is dominated by multi-channel distribution firms, while specialized single-distribution insurers have only small market shares.

Applying an empirical framework developed by Berger et al. (1997), we estimate cost and profit efficiency for three groups of life insurance firms with different distribution systems – multi-channel insurers, direct insurers, and independent-agent insurers – from a sample of German life insurers. Testing a set of hypotheses, we find economic evidence for the coexistence of the
different distribution systems, which is the absence of comparative performance advantages of specialized insurers.

According to economic theory, direct insurers should show higher cost efficiency than multiple channel insurers because of their advantages in terms of administration and acquisition cost. Independent agent insurers, on the other hand, should be able to compensate for their higher costs with higher revenues compared to multiple-channel insurers, as they provide a higher level of service quality. However, our results show that both hypotheses have to be rejected, since specialized single-channel insurers do not outperform multi-channel insurers in terms of either cost or profit efficiency and, thus, do not represent a superior distribution system. This result explains why their market share has remained small despite the increasing importance of direct distribution and the increasing use of independent-agent insurers in the German life insurance market.

Our results also explain the development in the distribution systems of the German life insurance industry after its liberalization. As had been expected, the dominance of exclusive agents which prevailed in the German life insurance industry until the 1994 liberalization has been declining in favor of distribution via direct channels and independent agents. However, specialized direct insurers and independent-agent insurers have not been the primary beneficiaries of this development; instead, it is the multi-channel insurers which have succeeded in incorporating additional channels into their distribution systems. Thus, one might conclude that distribution via multiple channels is superior to specialized distribution systems in the life insurance industry. Similar results are found for the banking industry, where multi-channel distribution also dominates the single-channel approach (Economist, 2000).
References


Kumar, N., Ruan, R., 2006. On Manufacturers Complementing the Traditional Retail Channel with a Direct Online Channel. Quantitative Marketing and Economics 4, 289--323.


Table 1: Outputs, Costs, and Revenues for German Life Insurance Firms, 1997-2005

<table>
<thead>
<tr>
<th></th>
<th>Multi-channel insurer</th>
<th>Direct insurers</th>
<th>Independent agent insurers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (Std. dev.)</td>
<td>Min</td>
<td>Max</td>
<td>Mean (Std. dev.)</td>
</tr>
<tr>
<td>Operating expenses</td>
<td>110524.65 (155243.17)</td>
<td>1122</td>
<td>1229534</td>
<td>19519.9 (22421.85)</td>
</tr>
<tr>
<td>Equity capital</td>
<td>77950.34 (112096.10)</td>
<td>1638</td>
<td>1101824</td>
<td>30648.84 (58317.46)</td>
</tr>
<tr>
<td>Output</td>
<td>904728.78 (346108.60)</td>
<td>1883</td>
<td>13501076</td>
<td>234039.20 (346108.60)</td>
</tr>
<tr>
<td>Premiums (net of reinsurance)</td>
<td>637550.86 (869262.51)</td>
<td>2233</td>
<td>8732933</td>
<td>204650.16 (275228.97)</td>
</tr>
<tr>
<td>Investment income</td>
<td>442014.45 (711634.25)</td>
<td>3468</td>
<td>9366708</td>
<td>99740.32 (162462.63)</td>
</tr>
</tbody>
</table>

Note: All variables are expressed in 2000 Thousand Euro units by deflating with the German Consumer Price Index.
Table 2: Comparison of average cost and scale efficiency scores by groups, 1997-2005

<table>
<thead>
<tr>
<th>Year</th>
<th>Multi-Channel insurers</th>
<th></th>
<th>Direct insurers</th>
<th></th>
<th>Independent agent insurers</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>CE_CRS</td>
<td>CE_VRS</td>
<td>SE</td>
<td></td>
<td>n</td>
</tr>
<tr>
<td>1997</td>
<td>64</td>
<td>0.508</td>
<td>0.604</td>
<td>0.843</td>
<td>9</td>
<td>0.282*</td>
</tr>
<tr>
<td>1998</td>
<td>69</td>
<td>0.552</td>
<td>0.646</td>
<td>0.849</td>
<td>11</td>
<td>0.25*</td>
</tr>
<tr>
<td>1999</td>
<td>71</td>
<td>0.499</td>
<td>0.605</td>
<td>0.836</td>
<td>10</td>
<td>0.230*</td>
</tr>
<tr>
<td>2000</td>
<td>65</td>
<td>0.538</td>
<td>0.620</td>
<td>0.862</td>
<td>10</td>
<td>0.307*</td>
</tr>
<tr>
<td>2001</td>
<td>62</td>
<td>0.435</td>
<td>0.551</td>
<td>0.803</td>
<td>8</td>
<td>0.320</td>
</tr>
<tr>
<td>2002</td>
<td>61</td>
<td>0.439</td>
<td>0.547</td>
<td>0.821</td>
<td>9</td>
<td>0.325</td>
</tr>
<tr>
<td>2003</td>
<td>60</td>
<td>0.401</td>
<td>0.527</td>
<td>0.786</td>
<td>9</td>
<td>0.370</td>
</tr>
<tr>
<td>2004</td>
<td>62</td>
<td>0.447</td>
<td>0.550</td>
<td>0.833</td>
<td>9</td>
<td>0.380</td>
</tr>
<tr>
<td>2005</td>
<td>60</td>
<td>0.384</td>
<td>0.544</td>
<td>0.737</td>
<td>10</td>
<td>0.308</td>
</tr>
</tbody>
</table>

*: Differences between efficiency scores are statistically significant between groups according to the Mann-Whitney-U-test. Multi-channel insurers were tested against direct and independent agent insurers. Detailed test results are available from the corresponding author on request.
Table 3:  Comparison of average profit efficiency scores by groups, 1997-2005

<table>
<thead>
<tr>
<th></th>
<th>Multi-Channel insurers</th>
<th>Direct insurers</th>
<th>Independent agent insurers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>PE(_{\text{VRS}})</td>
<td>n</td>
</tr>
<tr>
<td>1997</td>
<td>64</td>
<td>0.597</td>
<td>9</td>
</tr>
<tr>
<td>1998</td>
<td>69</td>
<td>0.624</td>
<td>11</td>
</tr>
<tr>
<td>1999</td>
<td>71</td>
<td>0.615</td>
<td>10</td>
</tr>
<tr>
<td>2000</td>
<td>65</td>
<td>0.624</td>
<td>10</td>
</tr>
<tr>
<td>2001</td>
<td>62</td>
<td>0.588</td>
<td>8</td>
</tr>
<tr>
<td>2002</td>
<td>61</td>
<td>0.501</td>
<td>9</td>
</tr>
<tr>
<td>2003</td>
<td>60</td>
<td>0.637</td>
<td>9</td>
</tr>
<tr>
<td>2004</td>
<td>62</td>
<td>0.588</td>
<td>9</td>
</tr>
<tr>
<td>2005</td>
<td>60</td>
<td>0.606</td>
<td>10</td>
</tr>
</tbody>
</table>

\(^*\): Differences between efficiency scores are statistically significant between groups according to the Mann-Whitney-U-test. Multi-channel insurers were tested against direct and independent agent insurers. Detailed test results are available from the corresponding author on request.