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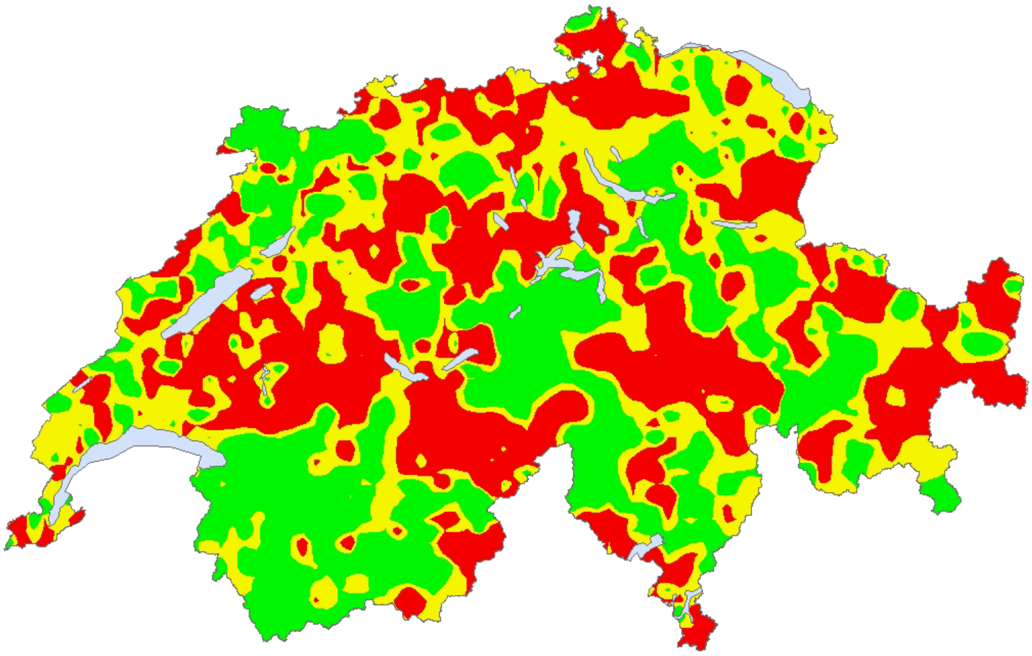

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Abstract

In this paper, we use cross-sectional business data of a cooperating major insurance company, and merge it with other available spatial data at municipal level in Switzerland to explain geographically varying market shares of its tied agent channel within the country. More specifically, the effects of distribution intensity by the tied agents and channel competition, among others, are considered in the proposed models, which also allow to identify areas of over- and underperformance. The results of the spatial econometric analysis indicate that the insurance market of the company is spatially organised.

Keywords

Spatial analysis; insurance distribution; distribution intensity; insurance performance; Switzerland

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1 Introduction

Since the early work of von Thünen (1842), Weber (1909) and Christaller (1933) researchers of various disciplines have theorized and empirically investigated the role of geographic space in the firm's choice of where to locate and in the performance implications of those choices. According to Doh and Hahn (2008, 661) much of the strategy research involving geographic or spatial constructs focuses on agglomeration economies and positive knowledge spillovers associated with locating near to other firms in a given industry, or proximate to other resources that could be valuable for founding patterns, firm's growth and development (i.e. Greve, 2000; Sorenson and Audia, 2000). An overview of the literature in the field of management is given in Sorenson and Baum (2003). They summarise that strategic interest in location appears recently greater than ever (Sorenson and Baum, 2003, 2), although it has been criticised that spatial constructs, spatial classifications and methodological approaches in empirical strategy research are often quite coarse (Doh and Hahn, 2008, 660). In marketing, there is a long tradition of considering spatial issues as well, although there has been some time of neglect in the past (Grether, 1983). But since the rapid improvement of data availability, techniques such as geographic segmentation (Ferrell and Hartline, 2005, 148) and the consideration of geodemographics (Harris *et al.*, 2005), locational considerations are common in marketing practice. This is no surprise given the manifold geographical questions in marketing such as in the field of distribution management, customer targeting and spatial resource allocation. Additionally, spatial modelling techniques are evolving in the field, acknowledging its usefulness in describing and analysing brands, consumers, markets, and other units of analysis, though not many references can be found in the literature so far. Jank and Kannan (2005, 623) are carefully summarising the current knowledge (Bronnenberg and Mahajan 2001; Bronnenberg and Sismeiro, 2002; Ter Hofstede *et al.*, 2002; Bronnenberg and Mela, 2004; Mittal *et al.*, 2004) by noting that the "findings seem to suggest that spatial data capture efficiently not only the geographical variations in supply side factors (…) but also variations in demand side factors (…) through variations in physical and psychological landscapes."

In this article, we are applying spatial analysis techniques to the insurance market in Switzerland. More specifically, the drivers of individual non-life and life premium market share in the tied agent distribution channel of a Swiss major insurance company are spatially analysed and modelled for the whole country at municipal level, i.e. for 2721 municipalities with an average of 3000 inhabitants per municipality. Cross-sectional business data of the insurance company are merged with other available spatial data at municipal level. The agent locations of all competing insurances with local representation are taken from the official register of insurance agents in Switzerland (Federal Office of Private Insurance, 2008). It is, to our knowledge, the first time that such a nationwide analysis from the financial services industry is reported at this level of spatial detail.

Despite the recent introduction and increasing success of new insurance distribution channels, the distribution via agents remains the main channel for many insurance companies. Usually, an agent of an insurance company is active in a local market and tries to sustain long-lasting customer relationships. Consequently, a close spatial neighbourhood of customers and agents can be assumed, although some restrictions apply. Uncertainties arise due to the fact that a policy holder might have moved from one to a different municipality while a policy is active. The same is not precluded for tied agent locations, as they might take their portfolio of customers and their associated policies with them to the new location. Moreover, a customer might not necessarily be tied to the next available tied agent as a company might not ensure exclusive sales areas to agents. Therefore, the spatial relationship of a tied agent to its customers might be only moderately strong. This will be further explored in the following.

1.1 Study objectives

The study has three objectives. On is to explore to what extent the insurance market is still *spatial* despite the increasing influence of non-spatial direct distribution channels, stipulating a spatial relationship between market share in the tied agent distribution channel, own and competitor agent presence, strength of other distribution channels of the company and characteristics of each municipality. Particular focus is on the role of market cultivation and competition. Does intense market cultivation with a strong field workforce lead to higher market shares and how does high competitor density affect the outcome? Another objective is to estimate the relative weights of the different factors which determine the market share of the company in the tied agent distribution channel in each municipality. The proposed models ought to provide general insights into the determinants of the market position with implications to both strategic management and marketing. The third objective is to determine if various distribution channels are spatially related and to analyse if there is any degree of cannibalization to the tied agent channel through alternative distribution channels, such as the direct channel and brokers.

The results of the research are useful in various ways. Consistent estimates of spatial models of market share and the coefficients of their predictors are of interest for managers and companies for the purpose of commercial planning and forecasting, market potential assessment, monitoring, workforce planning and marketing. For example, the optimal number of agents and their locations is an important strategic question for any insurance company with a tied agent distribution network. Moreover, residual maps of local spatial models can identify areas of over- and underperformance of a company.

The remainder of the paper is organized as follows: Section two gives an introduction into the determinants of insurance consumption on the demand side as well as distribution on the supply side, including issues in distribution intensity, channel competition and performance measurement. Therefore, the section helps to identify explanatory variables for the empirical part of the article. An additional subsection gives insights into the Swiss insurance market and a summary of spatially disaggregated market share studies in the literature. Section three describes the methodology and data while section four includes model estimations and maps the results. Finally, conclusions are given in section five.

2 Insurance consumption and distribution

In the insurance business, the non-life and the life insurance sector are usually distinguished and subject to different regulatory regimes and different tax and accounting rules on the supply side. The main reason for the distinction between the two types is that the life business is long-term in nature. The coverage for life insurance can cover risks over many decades. In a contrary, a non-life insurance, such as a liability or property insurance, usually covers a much shorter period. On the demand side, non-life and life insurance have different economic rationales which are reflected in the theoretical models of their consumption as well (see for example Mossin, 1968, for non-life and Villeneuve, 2000, for live insurances). Consequently, the distinction between non-life and life was acknowledged in this paper as well.

2.1 Empirical insurance demand literature

Two fundamental research approaches can be distinguished and have been applied in the empirical literature to investigate insurance demand (Schlag, 2004, 10): (1) Macroeconomic studies and (2) microeconomic studies. Macroeconomic approaches are either aggregated cross-sectional, time-series or panel analysis studies. Aiming to explain both life and non-life insurance demand, these studies (e.g. Enz, 2000; Beck and Webb, 2003; Hussels et al., 2005; Nakata and Sawada, 2007; Li *et al.*, 2007; a synopsis on life insurance demand is given by Zietz, 2003 and Schlag, 2004) are mostly done at country or cross-country level, where observational units are separated by borders which are to a great extent coincident with the spatial diffusion of the phenomenon of interest (Lenzi and Millo, 2005, 3).

Microeconomic studies try to explain individual decision-making patterns at household level. Examples are Galabo and Lester (2001), Japelli and Pistaferri (2002) and Dixon *et al.* (2006). Even in light of all this empirical work, some authors are pointing out that the understanding of insurance demand is still limited (Nakata and Sawada, 2007, 1). One reason is certainly that empirical studies in the field of insurance consumption have often the problem of overcoming significant limitations in data availability (Lenzi and Millo, 2005, 1). This is also the reason why there are only few studies on insurance consumption, which have considered the regional or even local spatial dimension of the insurance market in the past. Exceptions are Zhuo (1998) for a selection of regions and cities in China as well as Lenzi and Millo (2005) for Italian regions; but these are still rather large scale units.

Both income and wealth play a major role in insurance demand, and they are positively correlated. According to Nakata and Sawada (2007, 1) the standard model of insurance demand specifies the demand function as a function of the premium and the initial wealth rather than income. However, in the various studies at country level, wealth is often proxied by income or, when not observable, by the gross domestic product at country level (Schlag, 2004, 12). So is risk exposure, which is in turn related to total wealth and the level of economic activity (Lenzi and Millo, 2005, 6). Moreover, the literature suggests to capture risk aversion by education or the age structure of the population (Lenzi and Millo, 2005, 6). Various studies found out that better educated people purchase more insurance, even when controlling for the higher income levels associated with longer schooling.

Additionally, the spatially disaggregate dimension of insurance marketing and distribution is crucial for the insurance companies as for other businesses. However, very few studies acknowledge those opportunities in the field of insurance demand. One of the rare exceptions is Lenzi and Millo (2005). They studied the demand variation in the Italian insurance market at regional scale and found spatial effects. Consequently, they highlight the importance of taking the spatial perspective into account. As mentioned before, Clapp *et al.* (1990) analysed the effect of location of agencies and field offices on the profitability of life insurance. The authors concluded that “it would appear worthwhile for firms to invest in a systematic analysis of locational and demographic factors when planning distribution systems” (Clapp *et al.*, 1990, 447).

2.2 Distribution of insurance

Multiple distribution methods are applied in the insurance business (Kim *et al.*, 1996; Regan and Tennyson, 2000, 709). Although there is large heterogeneity in the importance of the various distribution channels among European countries (CEA Statistics, 2008, 48), the predominant distribution channel for the larger insurance companies in the individual market is often still the *tied agent channel* (Dumm and Hoyt, 2003, 28), particularly in German speaking countries (Accenture & Universität St. Gallen, 2005, 35). Tied agents are paid by a particular insurance company to sell only its products. In Switzerland, the number of field staff paid by the insurance companies has increased 30 percent during the last four years while the overall premiums income saw only a slight increase (Swiss Insurance Association, 2009). *Non-employee agents*, sometimes also called *exclusive agents*, are independent from the insurer and are typically small businesses and franchises with a well-specified contractual relationship with a single insurer. Agents with non-exclusive sales relationships are independent businesses with contractual agreements to sell the products of more than one insurer. These agents are called *multi-tied agents* or *independent agents*. *Brokers,* too, are independent businesses who may sell the products of more than one insurer. However, they have no formal contractual relationships with insurance firms and ideally represent the insurance purchaser as a client (Regan and Tennyson, 2000, 711). The *direct channel* via internet and phone exhibits rapid growth in new business in recent years but has achieved only a low absolute level to date. Although first direct distribution services were introduced in the nineties, its total market share has, for example, only reached 3 percent in Germany (Knospe, 2008) and 5 percent in Switzerland (Baumann, 2007; Schletti, 2008) so far, where anecdotal evidence suggest that standardised non-life products are predominant in this distribution channel due to its simplicity. Therefore, the tied agent system remains the back-bone of the distribution strategy for many insurance companies, but they are often following multi-channel strategies.

The ongoing competitive and technological revolution in the financial services industries has resulted in greater segmentation of distribution channels by lines of business, and greater use of multiple distribution methods by companies (Webb and Hogan, 2002, 338; Coelho and Easingwood, 2008), including the establishment of marketing relationships and alliances with non-insurance companies (Regan and Tennyson, 2000, 709). In the last years, non-insurance companies such as retailers, automotive manufacturers, banks as well as integrated financing and credit card companies have entered various national markets in Europe. The newcomers' main aim is to earn distribution commissions rather than bear the risk (PartnerRe, 2001, 7). Banks in particular are getting involved in manufacturing, marketing or distribution of insurance products, known as *bancassurance* (Artikis *et al.*, 2008). Certainly, the importance of alternative distribution channels has increased in the last years and will further expand in the near future (Accenture & Universität St. Gallen, 2005, 35; Graf and Maas, 2008, 19).

2.3 Distribution channel intensity, competition and performance

The effects of distribution intensity on demand and market share are not widely covered in the literature. While there are few studies available on retail goods (for overviews, see Frazier and Lassar, 1996 or Bucklin *et al.*, 2008, 473f), none has been found in the financial services industry, considering in particular multichannel distribution strategies where competitor and own market presence are taken into account. Bucklin *et al.* (2008, 474) summarise that “in light of the scant evidence, advice to managers has been largely based on theory, logic, and example”. However, in an older study Clapp *et al.* (1990) used the ratio of agents in a market area divided by aggregate market income to analyse the effects of location on the profitability of life insurance agencies. This measure seems to be attractive, but has to assume that spatial reach of the agents is uniform across space.

The issues of distribution channel competition and performance have found much more interest in the literature (i.e. Gaski, 1984; Frazier, 1999; Webb and Hogan, 2002; Coelho *et al.*, 2003; Coelho and Easingwood, 2004; Tsay and Agrawal, 2004; Neslin *et al.*, 2006). As in many other industries, insurers have the challenge to balance channel competition to maximize the premium income and profits. The phenomenon of the coexistence of tied agent and independent agent/broker distribution channel has been several times described in the literature and has been generally explained by either differences in service quality and clientele they attract (*product quality hypothesis*) or by prevailing information asymmetries, a lack of market transparency and other differences between the two distribution channels (*market imperfection hypothesis*) (Trigo-Gamarra, 2008, 390). Additionally, direct channels have been introduced in the more recent past, leading potentially to the cannibalization of other distribution channels used. In practice, there is often resistance of tied agents to any direct channel efforts, as they see it as pure rivals (Eastman *et al.*, 2002; Bannwarth, 2008, 9). However, recent theoretical work on insurance distribution systems (Pfeil *et al.*, 2008, 51) suggest that whether large sales through the direct channel does impact other channels and their profitability depends “on the relative magnitude of cannibalization versus market enlargement and the degree to which the increase changes the composition of offline customers’ types with respect to service cost.” Results from other industries have revealed that the addition of a direct channel through the internet does not have to cannibalize existing channels, at least in the long term (i.e. Deleersnyder *et al.*, 2002; Biyalogorsky and Naik, 2003, Avery *et al.*, 2009), and can even contribute to both financial and strategic company performance (Wolk and Skiera, 2009). Nevertheless, in a study of 62 U.K. financial services companies, it appeared that multichannel companies enjoyed higher sales levels but lower profits (Coelho *et al.*, 2003, 567). Valos and Vocino (2006, 27) suggest to enhance the integration between market segmentation strategy and channel strategy.

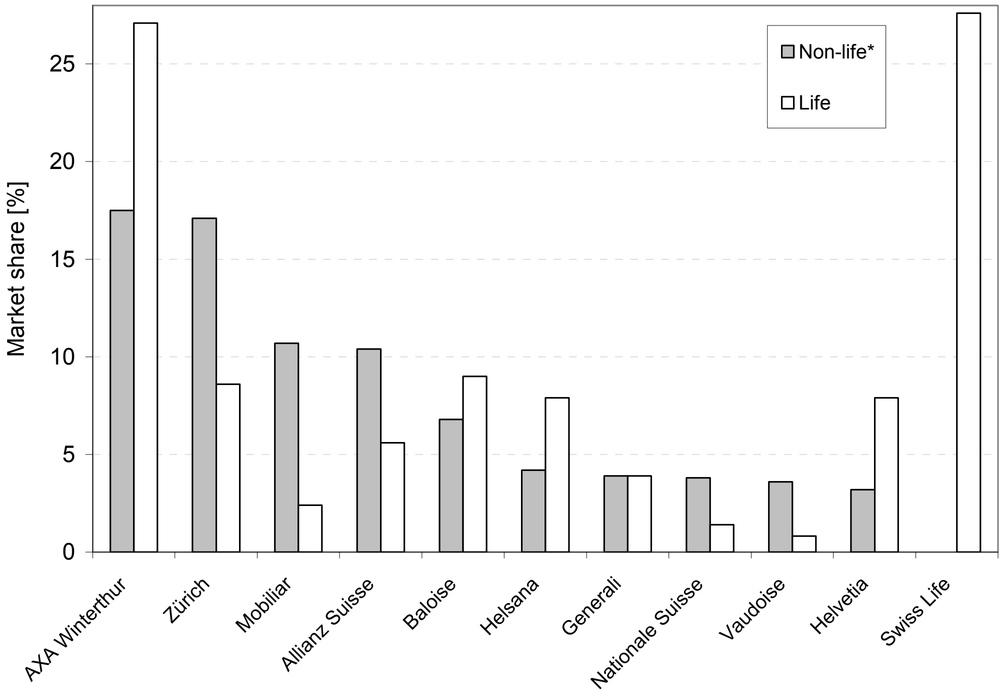
In any case, companies have to direct marketing efforts at the customers who have the highest potential to respond to those efforts in order to use resources effectively. This task includes the identification of the most suitable customers and their place of residence. Research has revealed that acquisition costs and the quality of an acquired customer including its value and retention differ substantially by distribution channel in the insurance business (Verhoef and Donkers, 2005). Therefore, optimisation models for allocation acquisition resources across channels have been suggested to maximize profit for a given budget (Neslin *et al.*, 2006). Nevertheless, their model provides only a global measure and lacks the ability to identify local markets where resource allocation might be particularly promising.

Many channel performance measures have been suggested in the past but particularly financial performance indicators have been criticised of being myopic (Webb and Hogan, 2002, 19). Valos and Vocino (2006, 17) are stating that current channel performance measurement guidelines are too generic for strategy and marketing managers as well as too reliant on financial measures. Moreover, they are describing that research in distribution channels has highlighted a channel performance metric paradox. According to this paradox, it is impossible for a business organisation to maximise all channel performance measures concurrently, because different systems and different channels necessitate particular measurement structure characteristics. Performance measures tailored for single distribution channels have been described from theory and practice (Löning and Besson, 2002; King and Liou, 2004) but approaches for multi-channel strategies are very scarce (Gensler *et al.*, 2007), mostly because comprehensive and cross-channel measures are needed as different channels might benefit from each other, for example when they are coordinated across stages of the customer decision process. In German-speaking countries, it has been found that the internet is often used for information and customer relationship management, but insurance policies are rather sold through face-to-face distribution channels (Psychonomics, 2007; Hattemer, 2008, 93). General evaluation criteria and performance measures such as gaining new customers, customer retention, customer satisfaction, market share, balanced source of revenues, cost of sales, sales growth and profitability have been suggested or empirically detected (Vuorinen *et al.*, 1998; Löning and Besson, 2002; Coelho *et al.*, 2003, 561). Nevertheless, such global measures miss the spatial dimension. For example, Bronnenberg and Albuquerque (2003, 217) are suggesting to commence by looking how distribution and communication channels are structured geographically when investigating the spatial concentration of market share of a company. This study acknowledges these suggestions and applies them to an example from the Swiss insurance market.

2.4 Swiss insurance market and market shares

Switzerland has the highest total insurance expenditure per capita in the world and is a well developed market. Within Europe, Switzerland has by far the highest non-life insurance expenditures per capita with 2450 US-Dollars and the third highest (after United Kingdom and Ireland) life insurance density per capita with 3112 US-Dollars in 2006 (SwissRe, 2007, 38). The average Swiss contract duration is around 10 years (Cap Gemini, 2008). The Swiss market for non-life and life insurances has been steadily deregulated during the 1990s. One of the last set of controls was scrapped in 1996 when the fixed tariff regime for third-party vehicle insurance was abolished (Credit Suisse Economic Research, 2005, 1). The deregulation was followed by the introduction of new services (i.e. assistance insurances, help points, etc.), product variety as well as new distribution channels (direct channels, such as phone and internet distribution as well as brokers). All this made the Swiss insurance market attractive for local as well as international insurance companies and has resulted in intense competition. According to the Federal Office of Private Insurance (FOPI), there were 26 life and 117 non-life insurers active in the market in 2007, which was however dominated by a minority of these companies. Figure 1 shows the ten largest non-life insurers in the Swiss market including both their non-life and life market share with regard to gross written premiums plus Swiss Life as the leading player in the life sector. These national numbers are silent about the market share of the companies by region or municipality within the country.

Figure 1 Market share of major insurer in Switzerland in 2006 (top 10 non-life)



Source: Federal Office of Private Insurance (FOPI), 4th quarter 2006
* excl. non-compulsory individual health insurance

Little research has explored the geographically disaggregated dimension behind those nationally aggregated data and its determinants, mostly due to data restrictions. On the contrary, it is very useful for strategy managers and marketers to have knowledge of the processes which generate those aggregated market outcomes. Few international studies can be found in the field of consumer packaged goods (Bronnenberg and Albuquerque, 2003; Bronnenberg *et al.*, 2007; Ataman *et al.*, 2007) and banks (Berger and Dick, 2007), focusing on the regional level like metropolitan statistical areas in the US. However, the studies predominantly investigate the advantage of an early market entry and the persistence of geographic differences in market share over time or the geographic variation in response to marketing-mix variables (Dubé and Manchanda, 2005; Lodish, 2007). Beyond, the available studies do not investigate further determinants of geographically differentiated market shares.

3 Methodology and data

The main source of data for this study is a major Swiss insurance company. Over the years, it expanded nationally and abroad both by taking over other insurers or by organic growth. In

Switzerland, it gained considerable market share in all regions of the country while its position remained particularly strong in its home market. However, no information is available about the time of entry in the various local markets. In 1990's the company was the first to introduce direct telephone marketing to the Swiss market, soon added by a full direct distribution channel via phone and internet with an increasing share of the yearly written new premiums. Despite this multi-channel distribution strategy, involving independent agents and brokers as well, tied agents remain the predominant distribution channel of the company with a total share of about four fifth of all active policies in summer 2007 while the direct distribution channel was responsible for about a tenth.

The company data provided information about the zip code of the customer location in Switzerland, policy type, selected distribution channel for purchase (including ID of the tied agent if applicable) and yearly premiums of all active policies as of summer 2007. Premiums were assigned to the location of the customer, only considering customers in the individual lines of business and therefore disregarding companies and other institutions. Although the policy information did not include the date of the contract, it can be assumed that many policies have been signed quite some time ago, particularly life insurance policies. The locations of all tied agents selling individual insurances are known as well. The company is not assigning market areas exclusively to their tied agents, and the raw data is distinguishing three types of agents in the company data set: commercial agents, individual agents and asset/financial consulting agents. However, for all three types, individual insurance policies constitute the majority of their portfolios. Consequently, all three agent types have been combined for the calculations below. More than 99 percent of the customers and all tied agent locations were successfully geocoded at municipal level.

Data about the total insurance demand in terms of written premiums by individuals from all insurance companies in the national market is available from a data provider[1] at municipality level, acknowledging that insurance demand differs significantly across Switzerland. The data has been used in this article to calculate the market share of the company for each of its distribution channels by dividing the written premiums found in the company data by the total insurance demand[2]. Additionally, the data has been used as an auxiliary variable to calculate agent density as described below. The data provider has disaggregated the data of the Swiss Household Budget Survey (HBS) from regional level (Grossregionen), based on household

[1] provided by bwv its GmbH, St. Gallen

[2] Due to confidentiality issues, data maps of market shares of the company can not be displayed here.

age, income and size. Therefore, those variables cannot be included in the estimates below due to methodological restrictions. Moreover, the data does not allow the study of the effect of distribution intensity on overall market demand, at least not at municipality level.

3.1 Calculation of an agent density measure

Insurance agents usually travel to their customer's home by car. Since it is certain that distribution and acquisition efforts of agents go well beyond of their home municipality borders of the partly very small Swiss municipalities, some kind of distribution intensity measure of the agent channel across municipal boundaries is needed. Therefore, the observed proportional origins of premiums by travel time of the company's agents to the location of their customers have been investigated and assumed to be the proportions of time agents are willing to allocate for their distribution efforts. For those calculations, a car travel time matrix of all Swiss municipalities based on the national person travel model (Vrtic and Fröhlich, 2008) was used. Intramunicipal (-zonal) travel time was calculated based on distance as suggested by Rietveld and Bruinsma (1998, 118):

$$d = \sqrt{\frac{\left(\frac{m}{\pi}\right) \times (\pi - 1)}{\pi}} \tag{1}$$

where d is the average distance between two arbitrary points within the area of a municipality m. The distance has been divided by an average assumed speed of 25 km/h. With the resulting values, it is possible to plot the share of premiums by travel time, measured from the municipality of the agents to the origin municipalities of the premiums, based on the following equation:

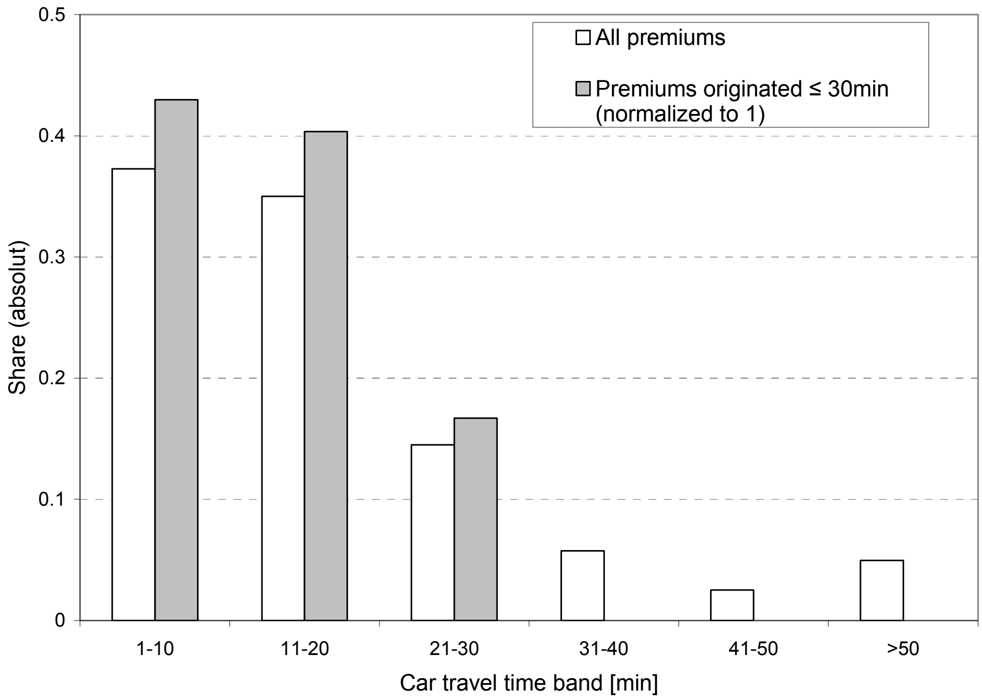
$$Sh_T = \frac{p_T}{p} \qquad \text{with} \quad T = [t_{1\text{-}10},\ t_{11\text{-}20},\ t_{21\text{-}30},\ t_{31\text{-}40},\ t_{41\text{-}50},\ t_{>50}] \tag{2}$$

where Sh_T is the share of the company's tied agent premiums p_T in car travel time band T measured in minutes from the agent home municipality to the premium originated municipality which is the same as the customer location. p is the sum of all premiums in the tied agent distribution channel of the company. The resulting shares are shown by the white bars in Figure 2. The analysis reveals that the majority of the premiums are originated within a distance of 30 minutes car travel time or less from the agent location, namely more than 87%.

However, around 13% of locations, which are originating premiums, are beyond 30 minutes car travel time and even 5% beyond 50 minutes. Earlier micro-analysis with the company's data revealed that customers of an agent are spread over the region and even scattered across the country (Hauri *et al.*, 2008, 28). This reflects the fact that there is often a long-term relationship of the agent to her/his customers which can last for example beyond a move of the customer. Exploratory data analysis also showed that the travel time distributions differ locally, due to variations in market sizes, the spatial distributions, natural barriers, accessibility etc., but they do not show any systematic pattern, therefore a uniform measure of agent density is pursued here.

For calculating agent distribution density, only the observed premiums within 30 minutes car travel time from the agent location in the company data were considered. Travel times beyond 30 minutes are omitted since it is assumed that these are special cases (i.e. the customer and/or the agent has moved since the moment of insurance purchase, the insurance has been purchased at the place of a second home or the home of the customer is exceptionally far away from the next tied agent). Again, Equation 2 has been employed but only considering travel time bands t_{1-10}, t_{11-20} and t_{21-30}. The results have been normalised to one as shown by the grey bars in Figure 2. Based on the calculations, it is assumed that an agent dedicates 42% of her/his distribution efforts to customers within 10 minutes travel time for example.

Figure 2 Origin of premiums by car travel time band from the company agent's municipality to the home municipality of the customers



However, this measure would uniformly allocate the same weight to any municipality within a travel time band, disregarding total market demand size and the market selection of the agents. To adjust this bias, it is assumed that an agent allocates its distribution efforts proportional to the market demand per municipality within each of the three travel time bands. The resulting agent presence of each tied agent was summed up for all tied agents of the company per municipality as follows:

$$AgP_m = \sum_{a=1}^{A} Sh_{Ta} \frac{d_{mT}}{d_T} \tag{3}$$

where AgP_m is the agent presence measure in municipality m, a is an agent located within 30min travel time of the municipality, A is the sum of all agents within 30min travel time, Sh_{Ta} the weight of agent a in travel band T, d_{mT} is the total demand of all households for insurances at municipality m in travel time band T and d_T is the total demand in all municipalities in travel time band T. The total demand for insurances was taken from the mentioned external database.

This agent presence measure per municipality was divided by the market demand in the municipality in terms of total annual individual non-life or life premiums, again coming from the external database:

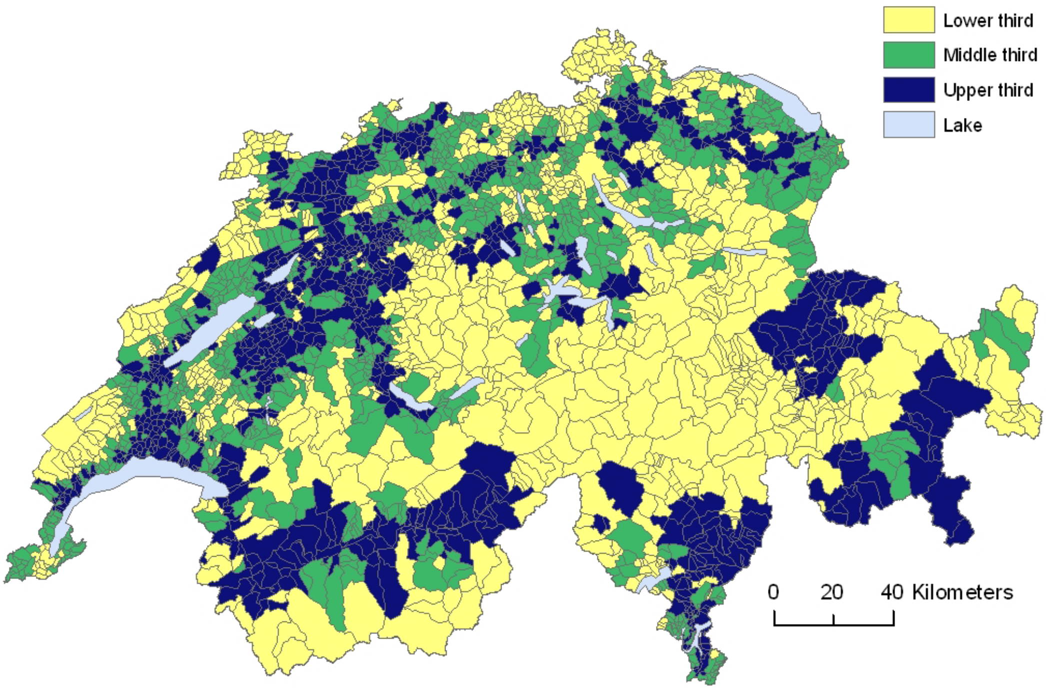
$$AgD_{sm} = \frac{AgP_m}{d_{sm}} \tag{4}$$

where AgD_{sm} is the agent density in insurance sector s (individual non-life or life) in municipality m, AgP_m the agent presence measure in the municipality as calculated in Equation 3, and d_{sm} the total demand in insurance sector s in municipality m. All company agents of the company are selling both non-life and life insurance policies. Therefore, there is no distinction of insurance sectors in the agent density measure for company’s agents. This agent distribution density measure extracts the theoretical efforts all active tied agents are devoting to any local market while adjusting for total market demand. However, this measure does weight all individual agents in the same way, not considering differences in experience, weekly hours of work or functional specifications. One agent might have additional administrative duties or focusing on wealth management of the customers. Nevertheless, explorative data analysis revealed that a negligible small portion of the company’s tied agents do not work full time and that the amount of written premiums is not correlated with the functional job classification in the data.

Clearly, the market share of a company is also a function of the amount of competition in any local market. Agent location data of all competitors (as of November 2007) were taken from the Swiss Federal Office of Private Insurance (FOPI), which maintains a database of registered agents since 2007. It is mandatory for independent agents and brokers to register and optional for tied agents[3]. The data included zip code as well as the city of the registered agent's work place and was manually enriched by the primary affiliation to an insurer if applicable and the assignment to a municipality through geocoding. If a primary affiliation information was present, it was assumed that this relationship is exclusive. There are several insurance companies active with tied agents in the Swiss market, which are offering either non-life or life insurances only. This is why, different than for the uniform agent presence calculation based on the company data, two separate competitors agent density variables have been generated: one for non-life, leaving out agents exclusively or predominantly working for a company only offering life insurance, and the other for life respectively. For both variables the same spatial diffusion has been hypothesised as for the company's tied agents and the same methodology for generating the agent density measure has been applied. In general, it was assumed that the tied agents of the various competitors missing in the database are missing at random, i.e. have the same spatial distribution as those registered. Only agents associated with an insurer have been considered while disregarding independent agents and brokers, as they can potentially sell insurances both from the company and its competitors. The agent density result for competitor non-life agents is mapped in Figure 3. This measure describes the density of non-life agents from all competitors of the company. It is displayed in three terciles so that the reader can easily identify areas of comparable low and high competitor non-life tied agent density. Therefore, there is low competition in lower third municipalities and high competition in upper third municipalities for the company from the tied agent channel of the competitors.

[3] Comparing company agent data with the register entries, around 60 percent of the tied agents are registered.

Figure 3 Map of competitors non-life tied agent density in Switzerland at municipality level



3.2 Additional variables and descriptive statistics

Some other variables at municipal level, which proved to have an impact on insurance demand in other aggregated empirical insurance demand studies (as described in section 2.1) were considered, namely education as measured in percentage of inhabitants with an university degree as well as vehicle ownership, as its correlation with income is weak. Additional factors, which are usually taken into account in cross-country studies, such as life expectancy, monetary stability, interest rate, social security, insurance regulation etc., are not useful here as there is no variation within the country. Consequently, they are omitted from the specifications. Finally, a set of dummy variables for the seven statistical regions (Grossregionen) of the country, as defined by the Swiss Federal Statistical Office, have been considered.

Due to different data sets referring to varying years and frequent municipal boundary changes over time due to municipal mergers in Switzerland, all data was adjusted to the municipal boundary system as of January 2007 with a total of 2721 municipalities. The complete set of variables used for the final estimations is summarised in Table 1 and their correlations are given in Table 2. More variables were tested, but were either insignificant or did not improve the models presented in section 4 (see Appendix for a list of tested variables). Both the non-life and life market share in the tied agent distribution channel of the company show significant spatial dependence, indicated by a significant Moran's I (Moran, 1950) of 0.306 for non-life and 0.111 for life.

Table 1 Descriptive statistics of variables at municipality level (N = 2721)

Variable	Abbrevation	Type[1]	Min	Max	Mean	S.D.
Company non-life market share in tied agent distrib. channel	MShNAg	C	0.000	0.340	0.068	0.033
Company non-life tied agent density	AgDN	C	0.000	0.036	0.001	0.001
Competitors non-life tied agent density	CtAgDN	C	0.000	0.035	0.003	0.002
Company non-life market share in broker distrib. channel.	MShNBr	C	0.000	0.091	0.005	0.007
Company non-life market share in direct distribution channel	MShNDi	C	0.000	0.051	0.008	0.006
Company life market share in tied agent distrib. channel	MShLAg	C	0.000	0.265	0.042	0.029
Company life tied agent density	AgDL	C	0.000	0.055	0.001	0.001
Competitors life tied agent density	CtAgDL	C	0.000	0.033	0.004	0.003
Company life market share in broker distribution channel	MShLBr	C	0.000	0.357	0.005	0.011
Company life market share in direct distribution channel	MShLDi	C	0.000	0.162	0.006	0.009
Vehicles per inhabitant	VepC	C	0.000	1.631	0.559	0.103
Percentage of inhabitants with university degree	UniDeg	C	0.000	0.455	0.096	0.064
Grossregion Lemanique	Regio1	D	0.000	1.000		
Grossregion Espace Mitteland	Regio2	D	0.000	1.000		
Grossregion Northwest Switzerland	Regio3	D	0.000	1.000		
Grossregion Zürich[2]	Regio4	D	0.000	1.000		
Grossregion East Switzerland	Regio5	D	0.000	1.000		
Grossregion Central Switzerland	Regio6	D	0.000	1.000		
Grossregion Ticino	Regio7	D	0.000	1.000		

[1] C = continues; D = dummy

[2] Reference case

Table 2 Correlation matrix of variables

Variable	MshNAg	AgDN	CtAgDN	MShNBr	MshNDi	MShLAg	AgDL	CtAgDL	MShLBr	MshLDi	VepC	UniDeg	Regio1	Regio2	Regio3	Regio4	Regio5	Regio6	Regio7
MshNAg	1.00																		
AgDN	**0.11**	1.00																	
CtAgDN	-0.02	**0.38**	1.00																
MShNBr	**0.08**	**0.05**	0.02	1.00															
MShNDi	**0.18**	**0.06**	0.00	**0.09**	1.00														
MshLAg	**0.43**	**0.08**	0.03	**0.06**	**0.10**	1.00													
AgDL	**0.11**	**0.99**	**0.37**	**0.04**	**0.05**	**0.08**	1.00												
CtAgDL	-0.02	**0.39**	**0.94**	0.01	0.00	**0.04**	**0.39**	1.00											
MShLBr	0.02	**0.05**	0.00	**0.21**	**0.08**	0.03	**0.05**	**-0.02**	1.00										
MshLDi	**0.11**	**0.06**	0.01	**0.09**	**0.36**	**0.12**	**0.05**	**0.01**	0.02	1.00									
VepC	**0.19**	**0.07**	**0.07**	**0.11**	**0.12**	**0.15**	**0.06**	**0.09**	0.03	**0.05**	1.00								
UniDeg	**-0.18**	**0.05**	**0.09**	**0.16**	**0.17**	0.01	0.04	**0.11**	**0.05**	**0.13**	0.16	1.00							
Regio 1	**-0.17**	-0.02	**0.09**	-0.03	**-0.09**	**-0.04**	-0.02	**0.12**	-0.02	-0.01	**0.12**	**0.34**	1.00						
Regio2	0.01	**-0.04**	**0.04**	**-0.15**	**-0.20**	0.00	**-0.04**	**0.05**	**-0.07**	**-0.09**	**0.00**	**-0.18**	**-0.35**	1.00					
Regio3	-0.04	-0.01	**-0.08**	0.03	**0.19**	-0.01	-0.02	**-0.11**	0.01	0.00	0.03	-0.01	**-0.19**	**-0.24**	1.00				
Regio4	**0.10**	0.03	**-0.06**	**0.09**	**0.43**	-0.02	0.02	**-0.06**	**0.09**	**0.23**	0.01	**0.12**	**-0.13**	**-0.17**	**-0.09**	1.00			
Regio5	**0.10**	-0.02	**-0.07**	0.02	0.00	0.00	-0.02	**-0.10**	0.01	-0.01	**-0.20**	**-0.19**	**-0.23**	**-0.3.**	**-0.16**	**-0.12**	1.00		
Regio6	**-0.08**	0.03	-0.04	-0.03	**-0.08**	**-0.04**	0.03	**-0.06**	0.01	-0.01	**-0.11**	**-0.11**	**-0.14**	**-0.17**	**-0.10**	**-0.07**	**-0.12**	1.00	
Regio7	**0.13**	**0.10**	**0.07**	**0.18**	**-0.07**	**0.14**	**0.10**	**0.12**	0.03	-0.02	**0.16**	**0.06**	**-0.14**	**-0.18**	**-0.10**	**-0.07**	**-0.12**	**-0.07**	1.00

Bold print: significance at 0.05 level

4 Estimates

It is hypothesized that the market share of the company in terms of individual premiums of the tied agent distribution channel in a municipality is systematically related to both the density of the company's and competitors' tied agents assuming that they are seeking to serve the same set of customer. Moreover, it is assumed that this tied agent market share is related to the market share of other distribution channels of the company and that every municipality constitutes a local insurance market. Nevertheless, one has to keep in mind that municipal data is aggregated according to rather arbitrary but historical administrative delimitations of territory which are however usually homogeneous with regard to language, legal regulations, tax system and so forth. Consequently, spatial effects might be present and have to be tested before relying on cross-section estimations. But in a first instance, a cross-section ordinary least square (OLS) regression is estimated where market share of the company's tied agent distribution channel has been selected as the dependent variable.

A logit transformation has been applied to the market share variables as suggested for example by Mosteller and Tukey (1977, 109). This transformation stretches the tails of the dependent variable of market share (originally 0 to1) so that the values are essentially unbounded:

$$z = \ln\left(\frac{p}{1-p}\right) \tag{6}$$

where p is the market share and z the transformed variable.

Logarithmic transformations were applied to the tied agent density measures. A quadratic term (for example, Reibstein and Farris, 1995, suggest a generalized convex cross-sectional relationship between retail distribution and market share) did not improve the models significantly. Since cannibalization effects of the broker and the direct distribution channel on the tied agent channel performance of the company might be present, their market shares are included in the estimates as independent variables. The data of the company's broker channel market share comprises both broker and independent agents.

With regard to the seven statistical regions (Grossregionen) of the country, the Zürich region, the biggest market, is the reference case in the estimates. The dummy variables are testing if there is any systematic over- or underperformance in the regions while controlling for all other independent variables in the models.

Separate OLS models were estimated for individual non-life (Table 3) and life market share (Table 4) in the tied agent channel of the company. In both models, the variance inflation factors (VIF) are below two for all independent variables, except for the regional dummies, indicating no problems with multicollinearity. Apparently, the tied agent non-life market share follows spatial principles as the significance of most variables at the 0.05 level and a moderate adjusted R-square of 0.174 indicate. The life model reveals a lower adjusted R-square of 0.125. Therefore, the non-life sector model achieves a better fit than the life model. It might be surprising that the life market seems to be less ‘spatial’ than the non-life market since in general life insurances tend to be sold more through face-to-face distribution channels than non-life insurances. The reason is probably that life policies usually have a longer duration, meaning that the spatial relationship of agent density and customer location is relaxed due to relocations of the customer or the agent over time. Additional factors might be omitted variables and the generally higher market penetration in the non-life market of the company, indicated by higher and more evenly distributed market shares of the non-life tied agent channel of the company compared to the life tied agent channel. As can be observed in Table 1, the mean market share of the non-life tied agent distribution channel of the company is 2.6 percent points higher than the market share in the life tied agent channel, while both variables have almost the same standard deviation.

But the Moran’s I test the OLS residuals indicated spatial autocorrelation for both models, based on a queen type contiguity matrix. The Moran’s I for the non-life OLS models had a value of 0.172 and the life OLS a value of 0.051, both highly significant. Therefore, the Lagrange Multiplier test (Breusch and Pagan, 1980) was applied. The results indicated to work further with a spatial lag model (Anselin, 1988, 34) which can be written as follows.

$$y = \rho Wy + X\beta + \varepsilon \tag{7}$$

where y is a N by 1 vector of market share of the company’s tied agent distribution channel (N is the number of municipalities), ρ is a spatial autoregressive parameter, Wy is the corresponding spatially lagged dependent variable for weights matrix W, X is a N by K matrix with observations on municipality characteristics K, β is a K by 1 vector of regression coefficients and ε is a N by 1 vector of error terms.

Comparing the OLS results with the spatial lag models, the models for both non-life and life have improved measures of fit. An increase in the log-likelihood value as well as the decrease of the Akaike Information Criterion (AIC) and the Schwartz Criterion (BIC) all suggest an improvement of fit for the spatial lag specification for both non-life and life. Moreover, most coefficients are becoming lower resp. less negative with the spatial lag specification except for the non-life broker channel market share and some of the regional dummy variables.

In all models, the coefficient of the tied agent density of the company is positive and the competitor's density negative. Therefore, the coefficients show the expected result and a higher company tied agent density increases whereas a higher competitors tied agent density decreases the tied agent market share of the company. The company might be less vulnerable in the life sector to additional competitor tied agents indicated by the low values of the competitor tied agent density (CtAgDL) compared to the CtAgDN parameters in the non-life sector, but the coefficients are insignificant both in the OLS and the spatial lag model.

Remarkably, both the company's market share in the broker and direct distribution channel are significant and have positive signs for non-life and life, suggesting that a high market share in these distribution channels leads to higher market share in the tied agent distribution channel. Although the relationship could be vice versa or actually interact in both directions, the results cast strong doubts on the notion that the direct and broker channels impact the tied agent channel negatively. Apparently, the company manages to coordinate the channel strategies by targeting different customer groups or the like. The distribution channels might also benefit from each other for example through word-of-mouth reputation and visibility. While the coefficient values are roughly the same for the direct distribution channel in non-life and life, the values are lower in the broker distribution channel for non-life insurances compared to life.

The company tends to have higher tied agent market shares in the non-life insurance sector in municipalities with high vehicle ownership, possibly because of its particular strong market position in car insurances, and marginally lower market shares in municipalities with a high percentage of well-educated people with college or university degree. The same positive relationship between tied agent market share and vehicle ownership can be stated for the life sector, but there is also a positive relationship with regard to percentage of well-educated people with college or university degree. Therefore, the agents seem to achieve a higher market share in municipalities with more well-educated people, who usually have an above average income.

Further insights into the spatial distribution of the market shares are given by the coefficients of the regional dummy variables. While all significant coefficients are negative in the non-life spatial lag model, all coefficients are positive in the life sector. Therefore, the market share of the tied agents of the company is weaker in several regions beyond the reference region of (Grossregion) Zürich in the non-life sector but stronger in the life sector. Apparently, even the regional market share distribution in the tied agent channel differs considerably among the non-life and life sector.

Table 3 Estimates for individual non-life market share in the tied agent distribution channel of the company (N = 2721)

y = MShNAg (logit)	OLS				Spatial Lag Model		
Independent variable	b	beta	sign.	VIF	b	beta	sign.
Constant	-2.192		***		-1.454		***
Ln(AgDN)	0.130	0.148	***	1.747	0.090	0.102	***
Ln(CtAgDN)	-0.057	-0.086	***	1.763	-0.041	-0.062	***
MShNBr (logit)	0.023	0.069	***	1.253	0.024	0.072	***
MShNDi (logit)	0.090	0.205	***	1.271	0.081	0.185	***
VepC	0.939	0.178	***	1.120	0.907	0.172	***
UniDeg (logit)	-0.122	-0.177	***	1.386	-0.102	-0.148	***
Regio 1	-0.289	-0.217	***	3.794	-0.168	-0.126	***
Regio2	-0.125	-0.107	***	4.610	-0.053	-0.045	
Regio3	-0.228	-0.135	***	2.568	-0.137	-0.081	***
Regio5	-0.008	-0.006		3.305	0.023	0.016	
Regio6	-0.275	-0.124	***	2.018	-0.151	-0.068	***
Regio7	0.054	0.025		2.105	0.049	0.023	
rho					0.359		***
F-Test	48.720		***				
Adj. R-square	0.174						
Log likelihood	-1932.860				-1835.150		
AIC	3893.719				3700.290		
BIC	3976.442				3788.921		
Moran’s I	0.172		***		-0.013		

Probability of rejecting H_0 = *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

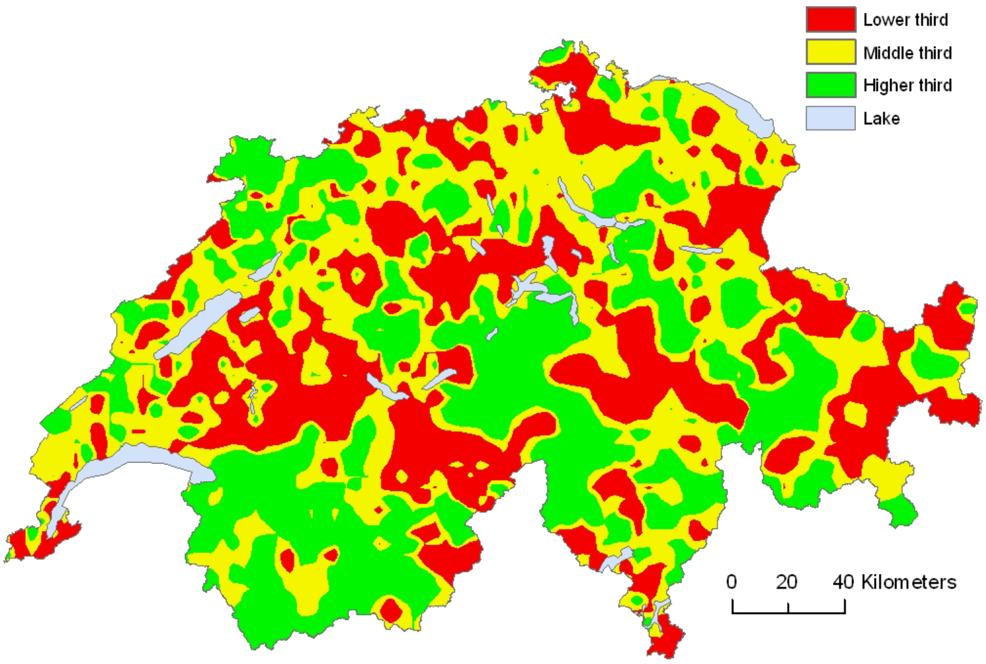
Table 4 Estimates for individual life market share in the tied agent distribution channel of the company (N = 2721)

y = MShLAg (logit)	OLS				Spatial Lag Model		
Independent variable	b	beta	sign.	VIF	b	beta	sign.
Constant	-1.813		***		-1.541		***
Ln(AgDL)	0.198	0.115	***	1.689	0.172	0.100	***
Ln(CtAgDL)	-0.019	-0.016		1.754	-0.017	-0.014	
MShLBr (logit)	0.055	0.103	***	1.253	0.050	0.093	***
MShLDi (logit)	0.103	0.196	***	1.249	0.098	0.188	***
VepC	1.269	0.124	***	1.106	1.235	0.121	***
UniDeg (logit)	0.096	0.072	***	1.359	0.092	0.069	***
Regio 1	0.051	0.020		3.874	0.064	0.025	*
Regio2	0.276	0.121	***	4.615	0.271	0.119	
Regio3	0.204	0.062	**	2.598	0.199	0.061	*
Regio5	0.184	0.066	**	3.330	0.197	0.070	*
Regio6	0.112	0.026		1.987	0.125	0.029	**
Regio7	0.296	0.072	***	2.071	0.267	0.065	
rho					0.143		
F-Test	33.370		***				
Adj. R-square	0.125						
Log likelihood	-3802.866				-3790.815		
AIC	7633.733				7611.631		
BIC	7716.455				7700.262		
Moran's I	0.051		***		-0.007		

Probability of rejecting H_0 = *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

By mapping the residuals of these models, it is possible to identify local markets and regions where the tied agent distribution channel of the company is either over- or underperforming. As an example, the residuals of the non-life spatial lag model are mapped in Figure 4. Due to confidentiality restrictions, the data presented has been interpolated by an inverse distance weight measure (Lloyd, 2007, 98) based on the residual values at the centroid of each municipality. Actually, the models provide metric values for every single municipality. In the figure, the data has been grouped in terciles. Areas in the lower third are indicating that the actual tied agent distribution market share is lower than predicted by the model, while areas in the upper third show higher market shares than predicted. Therefore, company's tied-agent distribution channel performance is rather weak for areas in the lower third and strong in the upper third, considering own to competitor presence as well as the other variables in the model. Local and regional variation across the country can be observed, and it is well below the spatial scale of the regions considered by the dummy variables in the models.

Figure 4 Smoothed residuals from the individual non-life spatial lag model



5 Conclusions

Behind aggregated national market share figures of nationally operating companies, local market shares can vary considerably within a country. Here, an example from the insurance industry was used at municipality level in Switzerland, applying business data from a major insurance company. In particular the market share of the tied agent distribution channel was analysed at municipal level for all of Switzerland. It was revealed that the market share is influenced by certain characteristics of the local markets. Therefore, differences in market shares can be explained by considering some crucial local factors. It can be stated that the non-life and life insurance market are spatially organised, meaning that the market share in the tied agent distribution channel follows spatial principles, explained by the significant independent variables in the models at municipality level.

A significant positive relationship between company's tied agent density and market share in the tied agent distribution channel were verified by developing a density measure based on revealed company data which is taking into account the fact that the distribution area of an agent goes well beyond its home municipality. As expected, a strong tied agent workforce helps to increase market share in the tied agent distribution channel whereas strong competition due to a high density of competitors tied agents certainly makes it more difficult to gain market share. With regard to channel competition, no indication of cannibalization has been found. The different distribution channels of the company even seem to be complementary as the correlation matrix (Table 2) and the model estimates (Table 3 and Table 4) are suggesting that higher market shares in the broker and direct channels lead to higher market shares in the tied agent channel, although the cause-and-effect chain could be vice versa or interrelated.

However, it has to be noted that several limitations apply to the presented analysis. First of all, the model fit particularly of the life model is relatively low. Apparently, there are factors other than the ones considered and unavailable for this study, which are determining the performance. On the supply side, regional performance differences in the tied agent channel might be present due to varying accessibilities leading potentially to longer travel times in some areas of Switzerland where the agents have to spend more time to reach their customers compared to other areas. Additionally, varying effectiveness among the tied agents might be present, which is certainly affected by experience but could also be due to variation of what the literature describes as sales person service behaviour, including factors such as diligence, information communication, inducement, empathy and sportsmanship (Ahearne *et al.*, 2007). Another limitation is the lack of information about spatially varying pricing policies, promotions and advertisement campaigns both of the companies and its competitors. However, the company claims that there are no locally varying price regimes after considering varying risk levels.

On the demand side, there might be additional influences present as well, which were not captured in the models. For the retail market, Bronnenberg and Mahajan (2001, 286) describe that differences in demand "can be caused by sheer inertia of initial market conditions, local order-of-entry effects, or can simply reflect regional consumer tastes". However, the time of local market entries are unknown and unavailable for both the company and the competitors, which forms a major limitation of the analysis.

By introducing marketing related variables to the models, such as marketing expenditure in local markets, including billboards, event sponsoring, regional press advertisement or TV spots etc., it would potentially become possible to evaluate and forecast marketing actions of the company. The analysis focuses on the investigation of an individual company. Certainly, it would be helpful to include disaggregated customer data of the competitors of the company. But it is rather unlikely that data of this spatial detail will ever become available for multiple market actors. Finally, only a static analysis based on cross-sectional data was performed, consequently ignoring industry trends. Further insights might be revealed by repeating the analysis at a later point in time or by a longitudinal analysis. Overall, the presented data analysis would not be suitable as a single performance measure due to the mentioned data restrictions although to some degree the models proved to be a helpful instrument to identify determinants as well as local areas of strength and weaknesses for the tied agent channel of the company.

Agent presence/density of the company is the only variable in the model which is directly controllable by the company's managers, while they might have only indirect control over the market share from the broker and direct distribution channels. However, maps of the resulting residuals of the models give suggestions of market success of the tied agent channel. There might be specific local reasons for underperformance, but it is up to decision makers to use those maps and data in strategic management and marketing. Particularly the insight that the different distribution channels seem to be complementary but also the measurement of the tied agent densities effect allows to develop geographically differentiated multi-channel strategies and an optimisation of resource allocation of marketing efforts and across distribution channels.

Finally, this example from the financial services industry revealed that spatial analysis and methods can help in various areas of strategic management and marketing, encouraging the use and exploitation of the spatial reference information of business data to improve the investigation of the spatial dimension of the unit of analysis.

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Appendix

Table 5 Variables tested but not included in the models due to insignificance

Variable
Share of home owners
Population older than 18 years
Share of male inhabitants
Share of inhabitant younger than 19 years
Share of inhabitants between 19 and 39 years
Share of inhabitants older than 59 years
Inhabitants younger than 19 years divided by inhabitants aged 25 to 49
Inhabitants younger than 19 years divided by inhabitants aged 25 to 54
Inhabitants younger than 19 years divided by inhabitants aged 25 to 59
Language regions (dummies: French, Italian, Rhaeto-Romanic)