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1 Introduction

Evolutionary models of organizational change have become an increasingly important part of the literature on organizational analysis. Most prominent organization theories explain diversity and change in organizational forms by the process of adaptation through individual organizations. Organizational ecology challenges this approach and argues that adaptation of organizational characteristics occurs at the population level through selective replacement of different organizational forms.[1] The theory attempts to explain long-rung organizational change in industries by analyzing founding and mortality events depending on the number of existing organizations, former founding and mortality rates and other population characteristics such as size and age of the organizations.

[1] *Carroll* (1997)

Empirical research in organizational ecology has mainly focused on analyzing founding and mortality rates using life history data of the organizations. We try to extend this approach in our study in a number of ways. In contrast to most empirical studies in organizational ecology, we chose a population of service organizations, the development dynamics of which are rather obvious in the innovative activities of existing organizations than in founding activities. We further discuss the points of contact between the organizational ecology approach and the theory of industry life cycles and extend the analysis to the relationship between innovative activities and population dynamics. The study examines the effects of population density, former events, and organizational size and age structure in the population of property & casualty insurance companies on the number of product innovations generated. We will further develop a concept for an insurance specific industry life cycle with a non-typical maturation and degeneration phase, and discuss to what extent the concept of Maslow's pyramid of needs can have explanatory power regarding the pattern of density dynamics. This study proposes an empirical framework for evaluating the hypotheses generated on base of the organizational ecology theory and the insurance specific industry life cycle. We estimate and report specific tests of the innovation rates using the traditional approach of event history analysis based on the negative binomial model.

2 Historical development of the German insurance market

The global insurance industry experienced a significant growth in the 20th century. The number of insurance companies increased from about 1.300 in the year 1900 to more than 14.000 today. More than a third of the companies are located in Europe.[2] The German insurance market of the year 1999 comprises approximately 2.000 companies.[3] In this chapter, we intend to give an overview of the development of the German insurance industry to one of the most important economic sectors of this country from two perspectives. First, we want to describe the key milestones in the evolution of the insurance sector from its origins against the background of the economic and political developments. Moreover, we will present the history of the German insurance industry in the light of technological inventions and the following insurance specific innovations.

[2] *Surminsky* (2000a, p. 112).
[3] *Bundesaufsichtsamt für das Versicherungswesen* (2000, p. 8).

The modern insurance industry in Germany is the result of a development process the roots of which lead back as far as to the origins of the idea of insurance in the antiquity.[4] In the legislative bill of the Babylonian king Hammurabi of the year 1750 BC, one can identify specific rules regarding financial arrangements of salesmen protecting them against losses of their caravans due to robberies. In the economy of the Greek empire around the year 200 BC, owners of merchant vessels could receive a loan before set the sails, which they had to return in case the vessels arrived safely in the harbor. 400 years later, the first life insurance was introduced in the Roman Empire. In middle Europe, the first contractual arrangements similar to today's insurance practice can be found in the so-called "Kapitulare" of the German emperor "Charlemagne" in the year 779. In this legislative bill, the mutual financial support of craft and trade cooperatives in case of fire accidents is described.

However, these first insurance agreements consisting of the mutual guarantees to support each other in case of an accident or an catastrophe differ significantly from today's insurance practice. The beginning of the modern, profit-oriented insurance industry in Europe dates back to the 14th century and has its roots in the Mediterranean countries as well as England and the Netherlands.[5] The essential difference to the ancient predecessors of the insurance was the fact that, for the first time, insurance premiums to be paid in advance were included in the contracts. The first arrangements of this nature are documented for the insurance of Italian ships in the second half of the 14th century. In the years following, this "innovation" made its way to England, Spain, the Netherlands and finally to Germany.

The German insurance industry is not only based on the import of the insurance idea via Mediterranean salesmen, but also on two other, independent lines of development. In the 16th century, craft and trade cooperatives started to offer their insurance products to customers, which were not members of their organizations. Apart form that, the first public insurance companies were founded in the 17th century by merging the administrations of already existing fire insurance contracts in big cities.[6]

Nevertheless, it was not before the founding of the first joint-stock insurance companies in Germany at the beginning of the 19th century that the insurance industry started to grow into a significant economic sector. The idea of insurance gained further acceptance within the society when the era of liberalism led to the founding of several private insurance companies.[7]

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[4] *Koch* (1988, p. 4ff.).
[5] *Wandel* (1998, p. 59).
[6] *Koch* (1988, p. 6) and *Wandel* (1998, p. 59f.).
[7] *Schieren* (1990, p. 21).

The industrialization and the increase of the living standards of major parts of the society led to the fact, that more and more people had "something to lose" and therefore also had something that needed to be insured. Insurance contracts were no longer a privilege of the upper class, but a "product for everyone". However, the "final breakthrough" for the German insurance industry came with the first social legislation in the year 1881. The introduction of a public medical insurance in 1883, a public accident insurance in 1884 and a sort of public pension insurance in 1889 did not imply a substitution of private by public insurance institutions, but helped to further spread the idea of insurance within the society, a development of which the private insurance industry profited significantly.[8]

The years between 1850 and 1900 must be seen as the period, in which almost all of the major product innovations were introduced into the German casualty & property insurance market, as can be seen in the following table.

Table 2.1: Year of the introduction of exemplary product innovations in the casualty & property insurance industry[9]

Class of insurance	Germany	UK	France	USA
Hailstorm	1719	1840	1802	1870
Animal	1765	1844	1805	
Accident	1853	1848		1864
Glass	1862	1852	1829	1874
Personal liability	1874	1875	1829	
Water	1886	1854		
Burglary/theft	1895	1846		1878
Credit/loan	1898	1820		1876
Car	1899	1896		
Machine/technology	1900	1872		

The industrialization and the development of new technologies also led to new needs of insurance, such as the classes of machine/technology or car insurance. At the same time, the government forced the employers to protect their employees against accidents at work, leading to the introduction of the accident insurance. As the potential claims in case of accidents caused by new technologies reached sums not experienced before by the owners of

[8] *Borscheid* (1990, p. 12).

[9] *Pearson* (1997, p. 239), *Borscheid* (1990), *Borscheid* (1988), *Koch* (1988) sowie *Arps* (1965). For the empty cells in the table, the year is not known. For the classes of fire, storm and transport insurance the exact date of introduction is not known.

machinery such as railways etc., the personal liability insurance became increasingly important.

The First World War caused a first major crisis of the German insurance industry. The total international business of the reinsurance and the transport insurance collapsed. The life and accident insurance companies first invested major parts of their capital into the so-called "Kriegsanleihen", war bonds issued by the government. Moreover, they had to pay enormous sums due to war casualties, which had been excluded from the insurance contracts before the war, but finally were reintroduced due to public pressure.[10]

Those companies surviving the war were hit by the next fundamental exogenous shock, the period of inflation in the twenties. At the beginning of this decade, the insurance market experienced a boom caused by the enormous surplus money created during the inflation. Many new insurance companies arose and even firms from the manufacturing industry decided to found own banks and insurance companies. However, only few of them were able to overcome the final devaluation of the money. Thus, this period experienced the most dramatic consolidation in the history of the German insurance industry.

The third fundamental exogenous shock in the first half of the 20th century was, of course, the regime of the National Socialists respectively the Second World War. In the thirties, the government tried to centralize the insurance market and forced lots of small companies to merge. The Second World War deleted not only the capital reserves of the insurance companies, but also their administrations. The medical and life insurance companies again had to pay enormous sums and the car insurance industry completely collapsed due to the destruction of the public infrastructure. The total insurance market of the Eastern regions was withdrawn after 1945, so that lots of insurance companies moved to the west.

However, just as the whole German economy, the insurance industry soon recovered from this catastrophe and experienced a period of steady and continuous growth after 1950. While the development of this sector was significantly influenced by fundamental exogenous shocks in the first half of the 20th century, in the last 50 years only two events need to be mentioned in this respect, the German reunification in 1990 and the deregulation of the European insurance market in 1994. The effects of both of these exogenous changes are not comparable to the effects of the crises before the Second World War. The German reunification more or less only led to a single increase in the insurance volume of Germany, which was almost totally captured by the major existing players in the market. The European deregulation was

[10] *Wandel* (1998, p. 63f.).

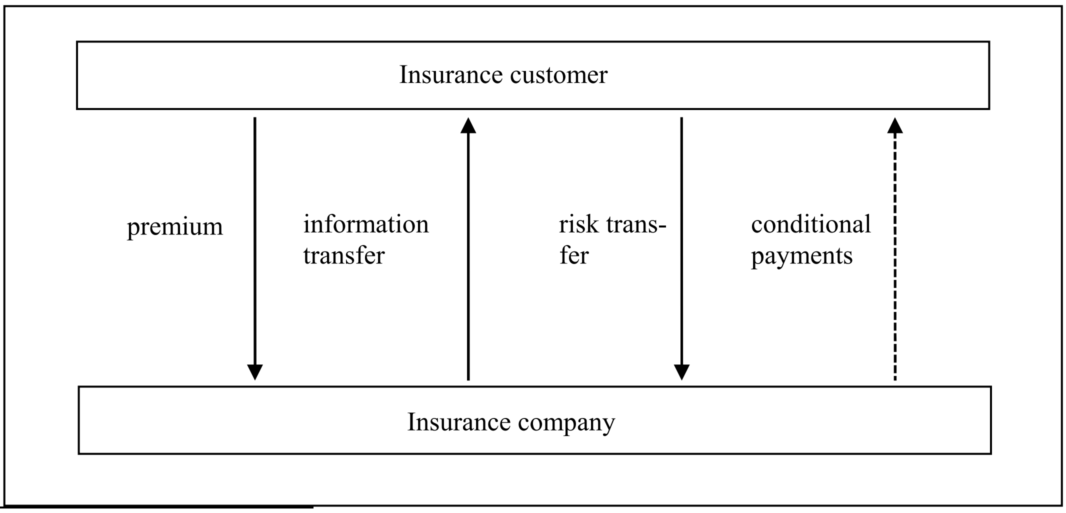
first believed to motivate international companies to enter the German insurance market. However, the major effect in the reality was the beginning of a price war between the existing companies, as the insurance offerings no longer had to be approved by the public authorities.

Moreover, the 20th century, in general, and the last 50 years, in particular, did not experience the same amount of fundamental product innovations as the 19th century. The major trends of this last epoch of the insurance industry were the diversification of the product portfolios of existing companies as well as the introduction of product modifications such as the combination of several classes of insurance in one contract, or the adjustment of the insurance premiums to the individual needs of the customers.

3 Product innovations in the insurance market

Before we can lay the theoretical base for the analysis of the historical development of the German insurance market and the role of product innovations in the evolution of this industry, we first want to define, what is the product created by an insurance company, and discuss the different forms of innovation in this sector. In the existing literature, there is more or less general agreement that the insurance industry belongs to the service sector.[11] However, there is not so much consent on how the product of an insurance company can be defined.[12] Albrecht (1992, p.4) sees the insurance product as a transfer of information and conditional payments from the insurance company to the customer and, at the same time, a transfer of risks and a monetary premium vice versa, as shown in the following figure:

Figure 3.1: Insurance as transfer of risk and information[13]



[11] *Farny* (1971), *Vielreicher* (1995) or *Haller* (1982).
[12] *Farny* (1979), *Müller* (1981).
[13] In Anlehnung an *Albrecht* (1992).

The insurance company sells a specific information regarding the insured object to the customer. The information consists of the *guarantee to pay a monetary equivalent for the object insured in case a defined event (accident, fire, etc.) occurs.* The customer pays a certain premium and transfers the risk of having a monetary disadvantage due to potential damage to the insurance company.

In order to define the different forms of innovation in the insurance industry, we differentiate between the subject and the object dimension of the product innovation.[14] In the subject dimension, the degree of newness is regarded from the perspective of the customer. If the product is new to the market, it is called *market novelty*. In case an insurance company introduces a product, that has not been in its product portfolio before, but already existed on the market, we call it *internal novelty*.

In the object dimension of an innovation, the degree of newness of an insurance product is measured from the perspective of the company offering it. We will follow the methodology of Vielreicher (1995) to differentiate between *product innovations* and *product modifications*. In his model, an insurance product can only be called innovative, if it creates a new "field of insurance". A field of insurance consists of certain risk factors (e.g. negligence or fire-raising), insured objects (e.g. houses or cars) and forms of incidents (fire or accidents). A innovative field of insurance is created, when one of those elements is changed completely or if parts of those elements are extracted and offered as an independent product. All other changes in the composition of the field of insurance are considered to be product modifications. Following this methodology, we create the following definitions:

Definition 3.1: A *product innovation* is called a *market novelty*, if an insurance company creates a new field of insurance that has not been offered on the market before.

Definition 3.2: A *product innovation* is called an *internal novelty*, if an insurance company offers a field of insurance that is new to the company, but already exists on the market.

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[14] *Widmer* (1986).

As the insurance industry is part of the service sector, one of the specific characteristics of the output produced is the difficulty to differentiate between the product and the process component of the good:

> *"The first analytical problem raised by services is the relatively fuzzy and unstable nature of their product. Indeed a service is a process, a sequence of operations, a formula, a protocol, a mode of organization. It is difficult, in many cases, to locate the boundaries of a service in the same way as those of a good can be fixed."*[15]

Services such as those offered by insurance companies are products as well as processes, as they are produced and consumed at the same time. Service companies cannot produce their output in advance and store it in order to sell it in the future. Similarly, customers of service companies cannot buy the goods and store it for later consumption. Therefore, the process of production is an essential part of the product itself. That is why the customers need to participate in the production process. Each service product hat a unique nature. It is produced according to the individual needs and problems of the customer. Customer interaction also plays a crucial role in the sales of service products. Muth (1988, p. 1586) claims that 80% of people buying a financial product such as an insurance contract insist on having a personal consultation with a representative of the respective company in advance.

Moreover, service goods are immaterial.[16] The customers cannot test the quality of the good to be purchased in advance. Thus, a certain degree of confidence is required in the product to be bought from the service company. This is especially true for insurance products. The product sold by the insurance company is the *guarantee to pay a monetary equivalent for the object insured in case a defined event (accident, fire, etc.) occurs*. This guarantee is not only immaterial, but the customer can only experience the quality of the product if the insured event actually happens. Therefore, the product has also a very abstract nature. Above all, in case of product innovations, the reputation and the image of the insurance company are essential factors for the success of the product. This is why customers often tend to buy insurance bundles form one company rather than several insurance contracts from different suppliers. Especially if the insurances purchased concern the basis of one's livelihood (e.g. life insurance, fire insurance etc.), people often stick to the supplier they have trusted before in other classes of insurance.

As service goods such as insurance products are immaterial, it is generally easy for competitors to imitate product innovations:

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[15] *Gallouij* (2002, p. xv).

> *"The vector of service characteristics ... is linked to possible functional imitation by all actual or potential competitors (including clients). The service characteristics are indeed highly visible and 'volatile', which makes them easy to imitate. The most convincing examples are to be found in financial and personal insurance services. The specifications of an insurance policy or of a financial product are in the public domain. They are object of firms' marketing and advertising policies (advertising leaflets etc.)."*[17]

However, while competitors can copy specific product characteristics quickly, it is far more difficult to reach the same level of reputation and customer acceptance first movers in the insurance market have. Kubli (1988, p. 87) assumes, that it takes approximately 6 months for a competitor to copy an innovative insurance product. According to Vielreicher (1995, p. 26) it can take more than 5 years for an imitator to gain the level of customer confidence needed to succeed in a new insurance class.

Another typical market characteristic of the insurance industry the companies have to keep in mind in the generation of product innovation is the *insurance-specific risk*. It stands for the fatal risk of an insurance company, that payments to be made due to the occurrence of insured events exceed the sum of the premium income and the capital reserves of the companies.[18] The *insurance-specific risk* comprises two elements, the risk that, by pure chance, the number of insured events is higher than the expected number, and the risk that the calculations of the probability of expected events by the insurance company are wrong. As for product innovations, the insurance companies, in general, only have limited experience in the specific estimations. Therefore the *insurance-specific risk* is especially high for innovative product offerings. Pearson (1997, S. 242) further differentiates between the *technical uncertainty* describing the uncertainty of the insurance companies regarding the optimal product offering and the *market uncertainty* as a lack of knowledge whether the innovative product will be accepted on the market. In either case, the insurance company can reduce the total insurance-specific risk by diversifying its product portfolio and, hence, spreading the risk over more fields of insurance.

[16] *Hipp* (2000, p. 19f.) *Gallouij* (2002, p. xv).
[17] *Gallouij* (2002, p. 128).
[18] *Albrecht* (1992).

4 Theoretical issues

We chose the organizational ecology theory and the industry life cycle concept as theoretical base for our analysis of the innovation dynamics in the German insurance market, since both approaches look at the evolution of whole industries and make assumptions about the determinants of the number of market entries. However, while most studies testing the relevance of the industry life cycle concept mainly focused on descriptive pictures of the observed evolution of industries[19], the analyses based on the organizational ecology approach tried to identify the determinants of the development dynamics based on various statistical models.[20] On top of that, the service sector has so far been widely neglected in lifecycle specific investigations, whereas population ecologists also tested the relevance of their concept in areas such as voluntary social service organizations[21], investment firms[22], credit unions[23] or the savings and loan industry[24].

In this chapter we will discuss both approaches and finally generate the hypotheses to be tested in the following empirical analysis.

4.1 The organizational ecology approach

"Why are there so many different kinds of organizations?" This question asked by Hannan and Freeman (1977, S. 956) in their well-known essay "The Population Ecology of Organizations" was the base for the development of the organizational ecology theory, an evolutionary approach trying to explain the long-term development of organizational populations, which has become an increasingly important part of the literature on organizational analysis. The organizational ecology approach differs from other organizational theories on change processes[25] especially in two points. First, it tries to explain the dynamics in the development of whole organizational populations,[26] and second, organizations are structurally inert. In contrast to adaptive theoretical approaches,

[19] While at least parts of the theoretical concepts regarding the product life cycle approach deal with the service industry (*Farny/Kirsch,* 1987, *Barras,* 1986a, or *Barras*, 1986b), this sector has not been investigated form a industry life cycle specific point of view yet.
[20] *Hannan/Freeman* (1989).
[21] *Singh et al.* (1991).
[22] *Messallam* (1998).
[23] *Barron et al.* (1994).
[24] *Havemann* (1994).
[25] *Carroll* (1997) gives a summary of the main other approaches.
[26] *Wiedenmayer* et al. (1995).

organizations do not change their structures actively, but superior forms replace them.[27] Organizational change happens through selection processes. The evolution of a population follows a Darwinian concept. The survival chances of organizations depend on the degree to which they meet the demands of the environmental conditions.

4.1.1 Model of density dependence

Based on Hannan's (1986) model of density dependence, the determinants of founding and disbanding rates in organizational populations are analyzed in organizational ecology theory.[28] An analogy to biological populations is used to explain evolutionary processes in the so-called concept of the niche. Just as populations of animals live in particular ecological niches, organizational populations also need a specific resource space for survival and reproduction. The resource space of an organizational population comprises elements like raw materials, technologies, customers or personnel. As the resource space of an organizational population is limited, populations cannot grow infinitely.

According to the model of density dependence, the processes of legitimation and competition determine the growth and development dynamics of an organizational population.[29] An organizational form is legitimate, if it is commonly accepted as the normal way of producing a specific organizational outcome. Competition effects are caused by direct competition between the members of an organization and diffuse competition, if organizations do not interact directly but still compete for the same resources. While legitimacy of an organizational form is supposed to increase the founding rate and heighten the survival changes at a decreasing rate, the effects of competition on the founding rate are believed to be negative.[30] All in all, the processes of legitimation and competition lead to a non-monotonic relationship between the density of a population and the founding and disbanding rates. The founding rate follows an inverted U-shaped pattern in dependence of the population density. It first increases to a maximum and then decreases to finally reach a stable, lower level.

Delacroix and Carroll (1983) extended the initial approach of density dependence by analyzing the effects of prior founding and disbanding rates on the further development

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[27] *Tucker et al.* (1990).

[28] The base for the population point of view in this approach is the so-called principle of isomorphism, first developed by *Hawley* (1968) in his human ecology approach. According to the principle of isomorphism, organizations that face the same environmental conditions will take similar forms and build an organizational population.

[29] *Carroll* (1993).

dynamics. They argued, that a high number of prior foundings indicates favorable environmental conditions and leads to more market entries. As in the case of population density, these effects are believed to be non-monotonic and become negative when a certain level is reached.[31] The density dependence model has experienced further extensions and various applications. On top of the analysis of development dynamics between different organizational populations[32] or between specialist and generalist organizations in the resource-partitioning model it was also used to study labor market dynamics[33].

While the initial concept of structural inertia did not allow for adaptive changes within organizations, meanwhile some scholars in the community of organization ecology research have claimed that under certain circumstances active change of organizational structures can also be analyzed from a population ecology perspective.[34] Especially the parting line between founding events and internal organizational change has been in the focus of the latest studies:

> "*If organization-level analysis routinely treat change and death as competing risks for individual organizations, the rise of network organizational forms makes it necessary for ecologists to model change and foundings as competing risks*." (Amburgey/Rao, 1996, p. 1275).

Particularly corporate organizations can choose between different strategies in entering new markets. They can build a new unit within the existing organization or modify the strategic direction of an existing unit. Alternatively, they might as well found a new organization, which is separated, from the existing business units. The first of those three alternatives can be regarded as a process of diversification by creating an internal product innovation in the way we defined it for the German insurance market in chapter 3. In the process of diversification, the organization faces challenges similar to those of entrepreneurs founding a new organization and those of enterprises going through structural changes. They are entering a new market and at the same time they are adjusting the strategic direction of an existing organization. Market entry by way of diversification has been examined in several studies based on the organizational ecology theory. In their analysis of the development dynamics in the US semiconductor industry, Hannan/Freeman (1989) regard both market entry by existing organizations and the founding of new companies as events affected by population density in the same way. Mitchell (1995) argues that diversification activities

[30] *Hannan/Freeman* (1989).
[31] However this hypothesis has received mixed evidence in empirical tests. While *Barnett/Amburgey* (1990) identify a continuously negative relationship, *Staber* (1989a) finds support for a positive, but monotonic influence of prior on future founding rates.
[32] *Wiedenmayer* (1992), *Barnett* (1990) or *Delacroix/Solt* (1988).
[33] *Windzio* (2001) or *Havemann* (1995).

represent changes in the peripheral structures of organizations, while Havemann (1993b) considers them to affect the core of the organization.

The motivation for diversification activities is mainly based on three elements.[35] The organizations can catch the opportunity to enter an attractive market, they might leave industries in which they cannot achieve the growth rates expected or they might regard their product range as investment portfolio and try to spread the entrepreneurial risk over several product groups. In the organizational ecology theory, the attractiveness of a market is determined by legitimation and competition processes. In accordance to Havemann (1994), we try to transfer the model of density dependence to explain diversification dynamics. We attempt to identify whether the market entries of existing organizations are affected by the same mechanisms that determine the U-shaped pattern of founding rates in dependence of population density.

However, population density is not the only factor to influence organizational change processes. Fligstein (1991) as well as Havemann (1993a) assume, that prior diversification activities in organizational populations might lead to imitation by other members of the population studied. They argue that an increasing number of market entries through diversification will increase the legitimation of this strategy and motivate other companies to imitate this way of market entry. At the same time, organizational ecology theory also believes that organizational size and age might have an impact on the willingness of organizations to go through structural change. Older organizations are believed to have higher structural inertia than younger competitors.[36] According to the liability of newness theorem, they have developed stable structures, internal hierarchies and external relations to key partners in the organization environment. These characteristics increase their survival chances, but at the same time strengthen the resistance to any sort of organizational change. The size of an organization is believed to have a similar effect. According to the liability of smallness theorem, organizations need to build standardized and formal procedures in order to cope with the increasing complexity that is created with increasing size.[37] Once again, those stable processes are supposed to help the organization to survive the selection mechanism in the evolution of the population, but also strengthen the resistance against change processes such as the diversification of the product portfolio.

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[34] *Kelly/Amburgey* (1991), *Amburgey/Rao* (1996).
[35] *Fligstein* (1991).
[36] *Aldrich/Auster* (1986).
[37] *Kelly/Amburgey* (1991).

4.1.2 Development of hypotheses

The core concept of the organizational ecology theory is the model of *density dependence*. As discussed in chapter 4.1.1, this approach has already been transferred to explain the dynamics of market entries of existing organizations by ways of diversification of their product portfolio in several studies.[38] Following this conceptual procedure, we also develop a hypothesis for the effect of population density on the market entries through internal product innovations. We assume, that the innovation rate shows a curvilinear pattern in dependence of the number of existing insurance companies due to the processes of legitimation and competition.

Hypothesis 1: The number of internal product innovations shows a non-monotonic, inverted U-shaped pattern with rising population density.

As discussed before, neither the organizational ecology theory nor the existing empirical studies can deliver consistent concepts and results on the relationship between the number of previous market entries and the further development of the entry rate. However, as several authors emphasize the importance of imitation processes for diversification activities in organizational populations,[39] we assume that a high number of previous product innovations is regarded as an indicator for positive market entry conditions and will therefore increase future innovation rates.

Hypothesis 2: The number of previous internal product innovations is positively related to future innovation rates.

While the organizational ecology theory and the comments on the specific characteristics of the demand for insurance products in chapter 3 both come to the conclusion that old organizations have higher survival chances due to the *liability of newness* (Hannan/Freeman, 1989) theorem respectively the importance of market reputation and market experience in the insurance sector, there is a significant difference regarding the respective judgments on the probability of market entry in dependence of organizational age. In the insurance industry where market reputation plays a crucial role in successfully entering new markets[40], one

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[38] *Havemann* (1992).
[39] *Fligstein* (1991), *Havemann* (1993b).
[40] See chapter 3.

would expect older companies to generate product innovations more easily. However, from a population ecology point of view, the structural inertia rises with increasing age and leads to a higher resistance against any kind of organizational change such as the diversification of the product portfolio via internal product innovations.

Hypothesis 3: Organizational age has a negative effect on the rate of internal product innovations.

In analogy to the arguments presented for hypothesis 3, the organizational ecology approach also claims that structural inertia rises with organizational size. The larger the organization, the more it relies on formalized and standardized processes and the higher is the resistance to change those routines. Hannan/Freeman (1984, p. 184ff) claim this to be the main difference between formal organizations and lose coalitions of individuals. The latter can respond quickly to any change of environmental conditions, as long as it is small enough to act without the need to delegate decisions within the organization. Otherwise, formalized processes are needed, which secure its survival through strengthening the reliability and accountability, but increase the inflexibility of the organization.

Once again, the assumption of large organizations having a lower propensity to generate a product innovation in counter-intuitive to what we have learned about the importance of market presence and a large customer network for insurance companies in chapter 3. However, when arguing form an organizational ecology point of view, the effect of structural inertia will outweigh the influence of the specific characteristics of the demand for insurance products. In accordance to Havemann (1994, p. 154f), who states that especially in populations dominated by a few large firms, market entry for smaller companies becomes more difficult due to increased diffuse competition, we assume a negative relationship between organizational size and the innovation rate in our last hypothesis.

Hypothesis 4: Organizational size has a negative effect on the rate of internal product innovations.

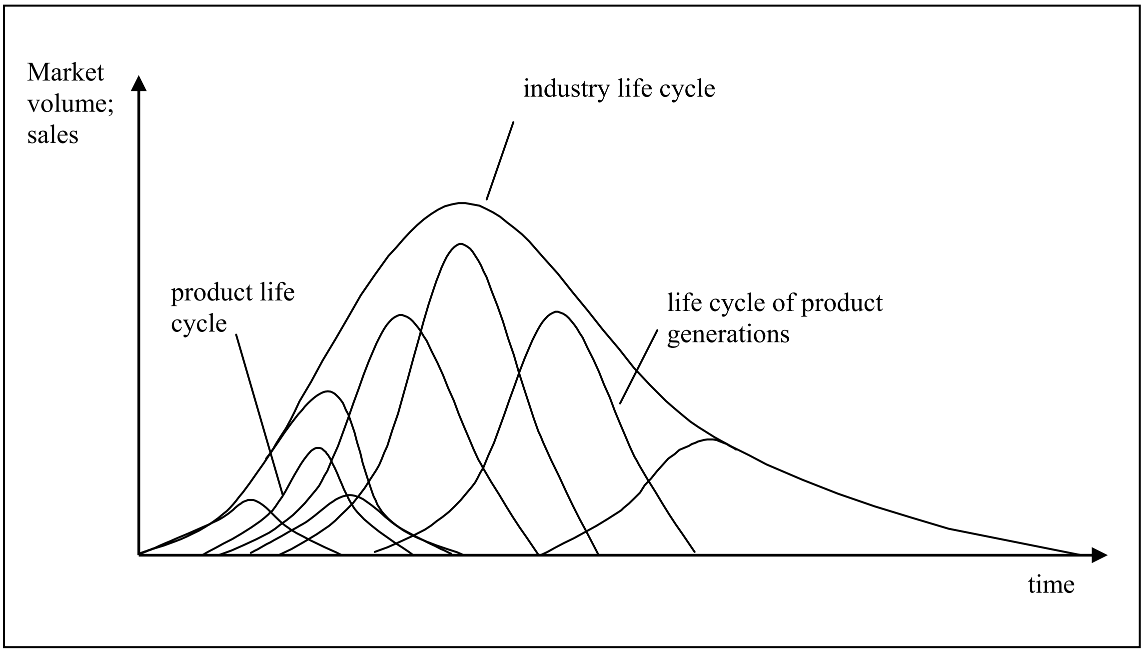
4.2 Industry life cycles in the insurance market

Biological lifecycles describe the development processes of an individual from birth to death. Economic life cycle concepts assume, that in analogy to biological organisms, economic systems also experience typical phases of development in their evolution.[41] In the economic literature, life cycle concepts were used to explain the development patterns of single products, organizations[42], technologies[43] and whole industries. In the standard model of the life cycle concept, specific characteristics of the unit of analysis such as sales volume, turnover or number of competitors first increase to a maximum, then decrease significantly and finally reach a level of stability, or they are discontinued completely.

4.2.1 Standard model and insurance specific modifications

In the industry life cycle concept, the unit of analysis is either the sales volume of an industry[44] or the number of competitors in the market.[45] If the development of the sales volume is analyzed, the industry life cycle is the sum of the life cycles of product generations and single products in the respective industry, as is shown in the following figure.

Figure 4.1: Product life cycles and industry life cycle[46]



[41] *Cathomen* (1996).
[42] *Höft* (1992).
[43] *Perez/Soete* (1988).
[44] *Höft* (1992).
[45] *Klepper/Graddy* (1990) and *Klepper/Simons* (1997).
[46] *Ford/Ryan* (1981, p. 120).

Similar to the industry life cycle model based on the sales volume of the products, the model regarding the development of the number of companies in the market also assumes an inverted U-shaped pattern.[47] After an increase in the number of competitors to a maximum due to high entry rates, the number of market exits exceeds the entries. Thus, the population density is reduced through a shakeout process and finally stabilizes at a lower level.[48] While there is general consent in the existing literature regarding the general pattern of the industry life cycle, its interpretations, especially regarding the massive market shakeout after the maximum differ significantly.[49] In general, the different concepts assume, that there is a shift in the innovative activities from product innovations in the beginning of the life cycle to process innovations in the latter phases, which forces companies not capable to adapt the innovations to leave the market.[50]

However, the existing studies analyzing industry life cycles exclusively focus on the consumer goods or the manufacturing industry, while the service sector is neglected completely. Only on the level of product life cycles, a few attempts were made to integrate the specific characteristics of the service industry into the life cycle concepts[51] The reason for the strong bias of life cycle studies towards the manufacturing industry may lie in the fact that products in these sectors show relatively high death and innovation rates, so that product life cycles can be identified easily. In contrast to most goods in the manufacturing sector, the motivation for the purchase of an insurance product is based on the long-term need for precautions against essential risks in one's livelihood. Farny and Kirsch (1987) therefore claim basic insurance classes such as life or fire insurance to be "immortal products".

Another difficulty in modeling the product life cycle in the insurance industry is caused by the specific characteristics of the demand for insurance products. Their life cycles overlap with external factors such as the density of the population, the number of potential risks to be insured or the insurance specific legislation. Besides, as the customer buys many insurance products in bundles, it is hard to identify single product life cycles. Considering this reasoning, Vielreicher (1993) assumes that the product life cycle of an insurance product shows an atypical pattern, as can be seen in the following figure:

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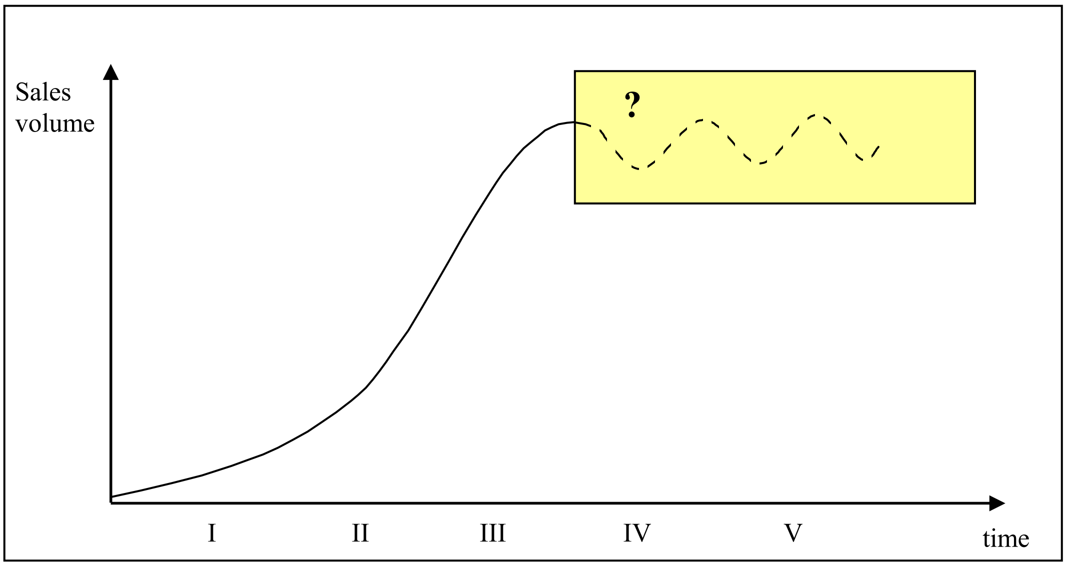
[47] *Gort/Klepper* (1982).
[48] *Klepper* (1997).
[49] *Utterback/Suárez* (1993), *Jovanovic/MacDonald* (1994) or *Klepper* (1996).
[50] *Utterback/Abernathy* (1975) and *Abernathy/Utterback* (1978).
[51] *Barras* (1986a) or *Barras* (1986b).

Figure 4.2: Life cycle of an insurance product



In the first three phases, the insurance life cycle is similar to the standard model. After the product introduction, the sales volume increases to a maximum. In the maturation and degeneration phase of the life cycle however, the shape cannot be determined ex ante. The sales volume may decline as in the standard model, it may as well show further increases or remain stable. The reasons for this atypical pattern lie in the specific characteristics of the demand for insurance products. Firstly, an insurance product life cycle basically consists of two life cycles, one for the new insurance contracts sold and one for the premium income generated by the existing contracts. Thus, an insurance product can still generate volume, although the insurance companies may not even offer it anymore. On top of that, the "immortality" of certain insurance lines such as life or fire insurance prevents the product to finally die out after the maturation phase.[52] Innovative insurance classes mainly supplement the existing products, but they do not substitute them.

As it is not possible to clearly determine the shape of a single life cycle of an insurance product in the maturation and degeneration phase, the pattern of an industry life cycle consisting of the sum of all individual product life cycles cannot be determined either. However, a possible explanation of its development can be derived from the specific income elasticity of the demand for insurance products on an aggregate level. In the existing literature, there have been only limited, but controversial discussions regarding the income elasticity of the demand for insurances. Koeniger (2001) claims in his analysis of the UK car

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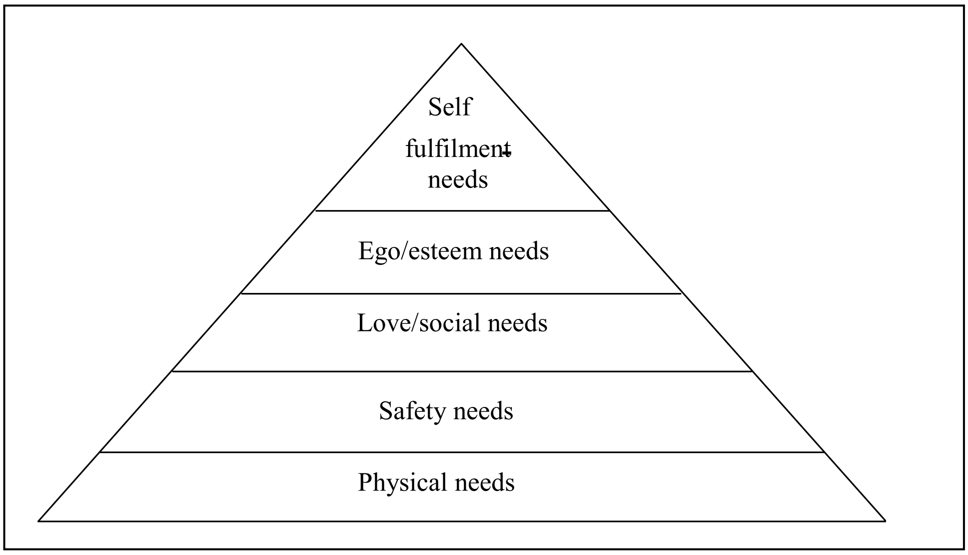
[52] In the history of the German insurance market, only a few exotic insurance lines such as the "rain insurance" or the "riot insurance" died out in the evolution of the industry. See *Borscheid* (1990).

industry, that higher income leads to lower demand for car insurances, as high-income households can afford to pay for potential repair costs more easily. Eisenhauer and Halek (1999) as well as Banerjee and Newman (1991) identify a positive relationship between the income level of a household and its risk aversion. Geiger (1992) analyzes the demand for personal liability, accident, legal costs, and household insurances in Germany. Following his results, there is a positive effect of household income on the insurance density in the population.

A different approach to the demand for insurance products is based on Maslow's theory of human motivation, according to which there is a hierarchy of needs observable in the goods consumed by the people.[53] Maslow develops a pyramid of needs consisting of 5 different levels, as is shown in figure 4.3:

Figure 4.3: Maslow's pyramid of needs[54]



On the lowest level of Maslow's pyramid, there are the basic physical needs such as food, shelter or clothing. The second level describes the need for safety in the sense of protection from all kinds of physical and psychological threats. It stands for the need to feel free from all kinds of anxiety. On top of the safety needs, Maslow sees the need for social contacts and love, the need for esteem in the sense of respect, status and competence and finally the need for self-fulfillment. Maslow's model claims that this hierarchy determines everybody's behavior. The needs on higher levels only become relevant, if the lower levels are already

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[53] *Maslow* (1977).
[54] *Brösse* (1999, p. 26).

satisfied.[55] On the other hand, once a higher level is reached, people are supposed to focus their activities completely on the fulfillment of the respective need.

It is quite obvious that the demand for basic insurance products is assumed to be part of the second level of Maslow's hierarchy, the need for safety. The history of the German insurance sector yields several examples supporting this hypothesis. In the early years of the insurance industry, in the middle of the 19th century, the purchase of an insurance was a privilege of the upper class. However, once the industrialization raised the living standard of major parts of the population, insurances became popular for lower classes as well. On the other hand, immediately after the Second World War, the priority of the population was to satisfy the basic physiological needs. Only after the economy recovered and the basic needs were fulfilled in the beginning of the fifties, the insurance industry experienced a significant uptorn.[56]

While the physiological needs of the population can be regarded as being more or less satisfied after the 1950s, this is not necessarily the case for the need for safety. In the last 50 years, almost all classes of insurance in Germany experienced significant growth rates. On the other hand, Geiger (1992) identified that even at the beginning of the nineties 40% of the private households in West Germany did not have a life insurance and 70% in the Eastern parts did not have an accident insurance.

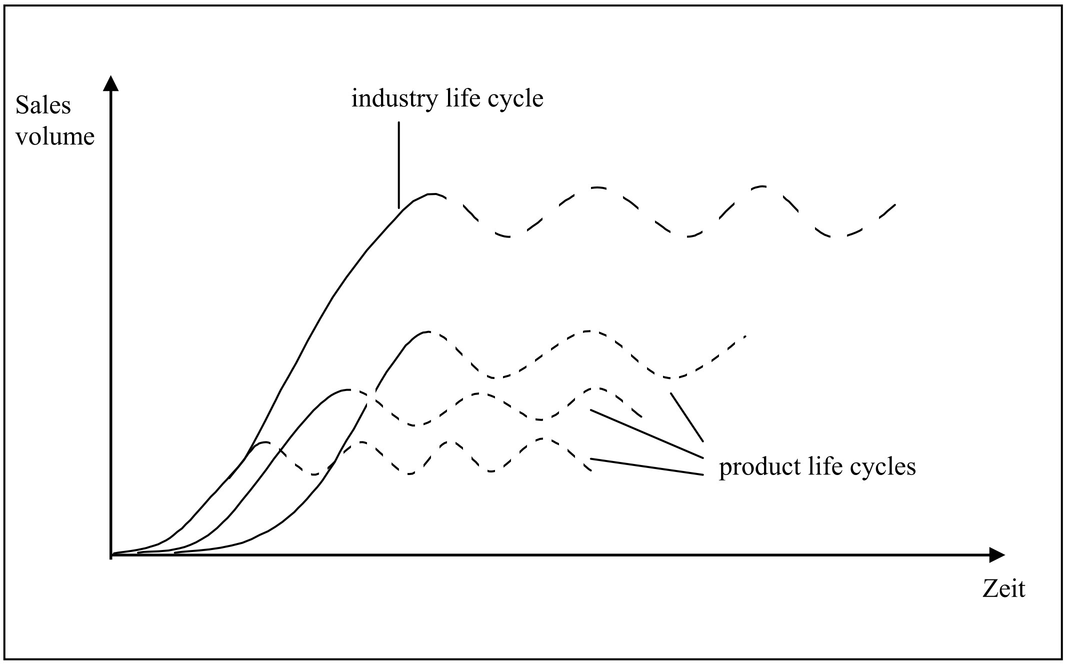
Moreover, the concept of the Maslow's pyramid of needs also helps to explain the further growth of the insurance population after the economic upturn in the fifties and sixties. Once the second level of needs is satisfied, people seek for new goals such as the need for esteem and self-actualization.[57] One way to fulfill these needs is the purchase and the consumption of specific products that are supposed to increase the recognition and accelerate the process of self-actualization. If the people nevertheless do not want to neglect the safety requirements of the second level of needs, they might demand additional insurance coverage. Hence, the life cycles of goods satisfying the higher level of needs should also affect the life cycles of the respective insurance products. A car insurance company will for example profit from an increase in national income, if this leads to a higher number of families having two cars. Thus, the life cycles of consumer goods of higher levels in the hierarchy are connected to the life cycles of the respective insurance products. The development of new needs in the population along Maslow's hierarchy does not only induce further growth in the existing

[55] *Hagerty* (1999).
[56] *Borscheid* (1990) or *Surminsky* (2000e).
[57] *Maslow* (1977, p. 85ff).

insurance classes, it also leads to the generation of innovative insurance products. Classes such as the insurance of journeys, of domestic animals, of art or musical instruments do not satisfy the need for safety regarding essential risks in one's livelihood. They give additional protection in the fulfillment of higher levels of Maslow's hierarchy.

All in all, we have two sources for the derivation of an insurance specific industry life cycle, the pattern of the product life cycle in the insurance industry and the specific characteristics of the demand for insurance according to Maslow's model. Combining those two approaches leads to an industry life cycle, as shown in the following figure.

Figure 4.4: Product and industry life cycles in the insurance industry



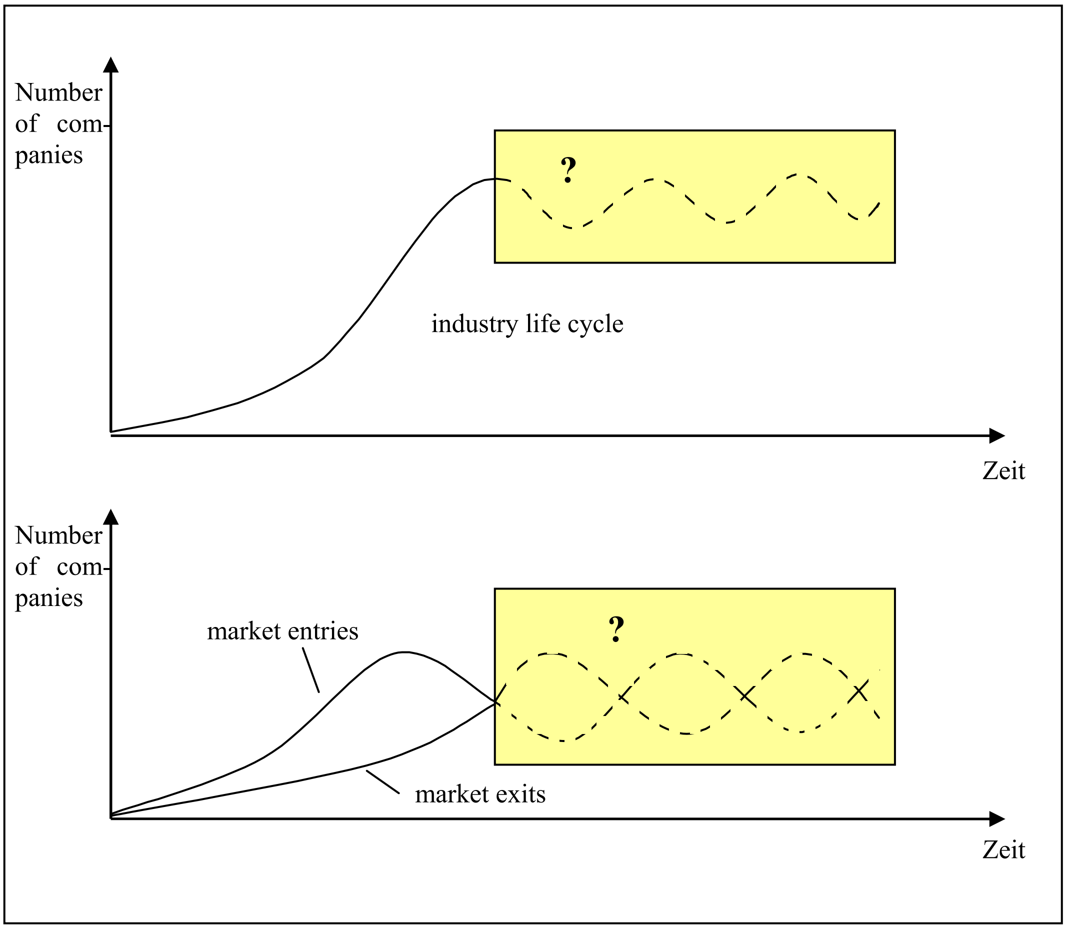
Similar to the standard model, the industry life cycle of the insurance sector starts with the introduction of the first product innovation. As more and more supplementary insurance classes are added, the industry life cycle measuring the total sales volume increases to a maximum. However, since the shape of the life cycle cannot be determined for neither of the individual products, it is also impossible to see ex ante, how the aggregated industry life cycle will develop once a certain maximum is reached. Considering our theses regarding the specific characteristics of the demand for insurances in Maslow's model, we claim, that in this atypical maturation or degeneration phase, the shape of the industry life cycle will be determined by the general economic development.

Based on this model, we can also derive the insurance specific industry life cycle describing the development of the number of competitors in the market. In this respect, the standard model assumes an inverted U-shaped pattern along the life cycle of an industry. The increase in the number of competitors in the first phases of the life cycle also seems to be plausible for the insurance market. After the introduction of the first insurance products, a few companies will dominate the market. As it is fairly easy to imitate insurance products[58], other companies will soon enter the market. Thus, the population density rises up to a certain level. Once again, the shape of the life cycle in a mature market does not necessarily fulfill the assumptions of the standard model. In the manufacturing industry, various reasons for a market shakeout in the maturation phase are possible, e.g. the development of a certain technological standard which some companies are unable to imitate. In the insurance industry, the products are immaterial and potential standards can therefore be copied more easily. Moreover, due to the necessity to cope with the insurance-specific risk and the customers' demand for product bundles, insurance companies often have an incentive to diversify their product portfolio and enter new insurance markets, even when they have already reached a mature phase of the life cycle.

Again, the standard reasoning does not yield a satisfying theoretical base for the shape of the life cycle in mature insurance markets. Therefore, we return to the model of Maslow used in the derivation of the insurance-specific product life cycle. The standard model assumes that the number of competitors in the market decreases once a certain level is reached. However, if opposite to the standard development of the sales volume in the life cycle concepts, the insurance markets further grow in the maturation phase, companies still have an incentive to join the market. Therefore, we hypothesize, that in mature insurance markets, the respective industry life cycle measuring the number of competitors cannot be determined ex ante, but will mainly be influenced by the general economic and the market development. The respective shape of the life cycle and the dynamics in the market entries are shown in the following figure.

[58] See chapter 3.

Figure 4.5: Life cycle, market entries and exits in the insurance industry



4.2.2 Development of hypotheses

The main difference between the standard model and the insurance specific industry life cycle is the non-typical pattern of the latter in the maturation and degeneration phase. In its derivation in chapter 4.2.1 we assumed that the development dynamics of a population of insurance companies are not ex ante determined but depend on the growth rate of national income. This hypothesis was based on the assumption, that due to its unique income elasticity the demand for insurance products is mainly influenced by the level on the Maslow's pyramid of needs the majority of the population has achieved. Hence, the determinants of the development dynamics change as soon as the second level on the pyramid, the need for safety, is reached. We also use this concept to explain the rate of market entries through internal product innovations.

Hypothesis 5: If the industry life cycle shows a non-typical pattern in the maturation and degeneration phase, the rate of market entries is solely determined by the general economic development.

According to these industry life cycle specific hypotheses, the only external variable to be significant in the latter phases of the evolution of the insurance industry is the general market and economic development. All other factors to be taken into consideration in the organizational ecology theory are not supposed to have a significant effect.

Going forward, the empirical analysis of the German insurance population will have to consist of two parts. First, we will regard the general development of the population density to decide whether the years to be included into the analysis represent the non-typical maturation and degeneration phase in the insurance specific industry life cycle. Based on these findings, we will then test, whether the life cycle or the organizational ecology specific hypotheses are better suited to explain the observed innovation dynamics.

5 Data and methods

5.1 Data

In most of the empirical studies based on the organizational ecology theory, the criterion for the definition of an organizational population is the organizational output produced.[59] Following this approach we will concentrate on casualty & property insurance companies.[60] We will further neglect the many small local insurance companies only active in some regions of Germany.[61] The preferable empirical way to study the development dynamics of a population is to analyze its whole evolution starting at the beginning of the industry.

59 *Hannan et al.* (1995), *Swaminathan* (1995), *Barron et al.* (1994) or *Messallam* (1998).

60 Other classes of insurance such as life and health insurance as well as the complete sector of reinsurance companies are excluded of the analysis despite accounting for approximately 70 percent of the total premium income generated. However, the products offered in those four classes are either fundamentally different from each other (a life insurance company offering capital investment products can hardly be compared with a company selling products in the area of fire or car insurance) or are significantly influenced by the development of public institutions (the evolution dynamics of the private health insurance market fundamentally depends on the development of the public health insurance agencies).

61 Although this will potentially lead to a loss of information as these thousands of small companies may interact with the population of the non-local players via processes of diffuse competition, this restriction still seems reasonable due to their marginal economic importance.

However, due to the limited data availability only few studies have actually comprised whole life cycles.[62]

A complete picture of the evolution of the German insurance industry can only be drawn by extending the time period under investigation as far as to the 16th century.[63] Obviously, it is impossible to gather company specific data covering five centuries. Moreover, the development of this sector in the first half of the 20th century was significantly influenced by fundamental exogenous shocks such as the two World Wars and the period of hyperinflation in the 1920s. In the comments on the historical development of innovation activities in the German insurance market in chapter 2, we have also learned that the vast majority of fundamental market innovations were generated between 1850 and 1900, whereas the innovation activities in the time after the World War II were dominated by product modifications and internal product innovations. Hence, we will limit our analysis to the time after 1950. All in all, the database for our empirical tests consists of the life histories of 264 casualty & property insurance companies between 1950 and 1998 and comprises 8.369 data sets. For each of the companies and all the years we have information on the year and the kind of founding and disbanding, organizational changes, the complete product portfolio of the insurance company and the premium income per year and per class of insurance.

The specification of the endogenous variable in the analysis is based on the definition of the internal product innovation in chapter 3. An insurance company generates an internal product innovation, when it creates a new class of insurance respectively separates an existing insurance area form a class it has already offered before. In the data set analyzed, the population members had the possibility to diversify their product portfolio to the classes of personal liability, car, accident, fire, burglary/theft, glass, storm/hailstorm, machine/technology, nuclear sites, aviation, transport, credit/loan, animal, legal cost and other insurances. To test the relevance of the density dependence model for market entries through product innovations in *hypothesis 1* we used the number of existing casualty & property insurance companies to measure population density, and the number of internal product innovations, as defined above, in the year before to capture the effects of pervious events on future innovation rates in *hypothesis 2.*

[62] Exceptions are represented by the studies of the evolution of the telephone industry from the 19th century on in various states in the USA by *Barnett* (1990) and *Barnett/Carroll* (1987) or the empirical investigations on the population of automobile producers in the USA by *Klepper* (1997) and *Klepper/Simons* (1997).

[63] See the historical overview of the evolution of the German insurance market in chapter 2.

In the literature on organizational ecology theory there are several alternatives to control for size effects on the innovation dynamics, as stated in *hypothesis 4*. Brüderl and Jungbauer-Gans (1991) chose the number of employees to measure organizational size in their analysis of survival rates of young companies in Bavaria. Barnett und Amburgey (1990) study the effects of organizational size on competition processes in the population of telephone companies in the USA by looking at the total "mass" of the population defined as the total number of subscribers. Wiedenmayer (1992) uses average industry production of beer to analyze the relationship between organizational size in the population of German breweries and founding rates. A similar way was chosen for this analysis. The exogenous variable to capture the effect of organizational size on the innovation rate equals the average premium income of an insurance company in the population per year.

Just as in the case of organizational size there are also several ways to measure the relationship of organizational age and the founding rates to test *hypothesis 3*. Having in mind the long history of the German insurance market, looking at the values of average age in the population might lead to a distorted impression of the age structure due to the high number of very old organizations. Therefore, we will include two age specific variables in the analysis, the share of companies older than 40 years and the share of organizations, which are five years old or younger. Moreover, we will also measure the influence of the age variance in the population to get additional information of the role of rejuvenation processes in the population on innovation activities.

To test for the *hypothesis 5* regarding the relationship of economic development and the innovation dynamics we will measure the effect of the growth rates of premium income on the number of product innovations. At first sight, the national income would be the perfect determinant to test the relevance of our assumptions based on Maslow's pyramid of needs. However, the premium income and the national income show a correlation of $r^2 = 0{,}97$. Moreover, choosing the premium income as exogenous variable additionally allows to control for capacity constraints in the development of the market (Wiedenmayer, 1992).

5.2 Methods

In modeling the innovation process in the population of insurance companies, we define the population as the unit of analysis an treat internal product innovations as events in a count process.[64] The most common method to specify this process implies the use of a Poisson model.[65] The basic form of the Poisson process assumes, that the arrival rate of the events is a time independent constant. Let $B_t = b$ be the cumulative sum of product innovations generated at t. Then the arrival rate λ_t denotes the conditional probability to reach $b+1$. The arrival rate is specified as[66]

$$\lambda_t = \lim_{\Delta t \to 0} \frac{\Pr(B_{t+\Delta t} - B_t = 1 | B_t = b)}{\Delta t} = \lambda \quad \textbf{[5.1]}$$

The conditional probability that the number of product innovations generated in the population rises from b to $b+1$ within the infinitesimally small time period $[t, t+\Delta t]$ equals the constant λ. The arrival rate is independent from t or any other exogenous determinants. However, it is possible to include the time dependence and the effects of potential covariates x_{tj} by specifying λ_t as

$$\lambda_t = e^{\sum_{j=1}^{p} \beta_j x_{tj}} \quad \textbf{[5.2]}$$

Under the assumption of a Poisson distribution of the random variable B_t the coefficients β_j can be estimated in a Poisson regression with

$$\Pr(B_t = b) = \frac{e^{-\lambda_t} \lambda^b}{b!} \quad \textbf{[5.3]}$$

The Poisson regression has become the conventional method for event data analysis on population level. However, it implies some severe restrictions. The Poisson model is based on the assumption that the conditional mean and the variance of the random variable are equal:[67]

$$E(B_t) = Var(B_t) = \lambda_t \quad \textbf{[5.4]}$$

In the case of overdispersion, when the variance exceeds the mean, this can cause misleadingly small standard errors of the estimated coefficients. Thus, coefficients might

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[64] *Cox/Oakes* (1984). Analyzing the innovation dynamics on the level of the population in contrast to identifying organization specific determinants of the innovation activities is necessary due to the fact that multiple events can occur within one period and that we only can rely on yearly data. Moreover, our key interest lies in the innovation dynamics of the whole population, not in the company specific success factors and prerequisites for successfully implementing a product innovation. See *Carroll et al.* (1993).

[65] *Hannan/Freeman* (1989).

[66] *Wiedenmayer* (1992, p. 94).

[67] *Winkelmann* (1994, p. 25ff).

become falsely significant.[68] Therefore, we base our analysis on the negative binomial model, a modified version of the Poisson model that takes the possibility of overdispersion into account.[69] The negative binomial model assumes, that λ itself is a random variable, denoted by λ':[70]

$$\lambda' = \lambda u \qquad \textbf{[5.5]}$$

Just as specified in [5.2] for the standard model of the Poisson regression, the parameter λ is determined by the values of the exogenous variables x_i. Additionally, λ' is affected by the random term u, which is independent from x_i. Under the assumption, λ' has a gamma distribution $\Gamma(\alpha, \alpha/\lambda)$ with conditional mean λ and variance λ^2/α, the density function of the negative binomial model with Γ as gamma function and $\alpha, \lambda \in \Re^+$ respectively $b \in \aleph$ can be written as[71]

$$\Pr(B_t = b | \alpha, \lambda) = \frac{\Gamma(\alpha + b)}{\Gamma(\alpha)\Gamma(b+1)} \left(\frac{\alpha}{\lambda + a}\right)^{\alpha} \left(\frac{\lambda}{\lambda + a}\right)^{b}, \qquad \textbf{[5.6]}$$

For the conditional mean and the variance, it follows

$$E(B_t | \alpha, \lambda) = \lambda \qquad \textbf{[5.7]}$$

$$Var(B_t | \alpha, \lambda) = \lambda + \lambda^2/\alpha \qquad \textbf{[5.8]}$$

Since $\alpha, \lambda \in \Re^+$, the variance always exceeds the conditional mean. Hence, the negative binomial model allows for the possibility of overdispersion. The step to the negative binomial regression is taken by specifying λ according to [5.2] with $\alpha = 1/\sigma^2$. For $\sigma \to 0$ the negative binomial model converges into the Poisson model. The estimates of the parameters β_j are derived by maximizing the respective log-likelihood function.

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[68] *Cameron/Trivedi* (1986, p. 31).
[69] *Carroll et al.* (1993, p. 173).
[70] *Winkelmann* (1994, p. 112).
[71] *Winkelmann* (1994, p. 113ff).

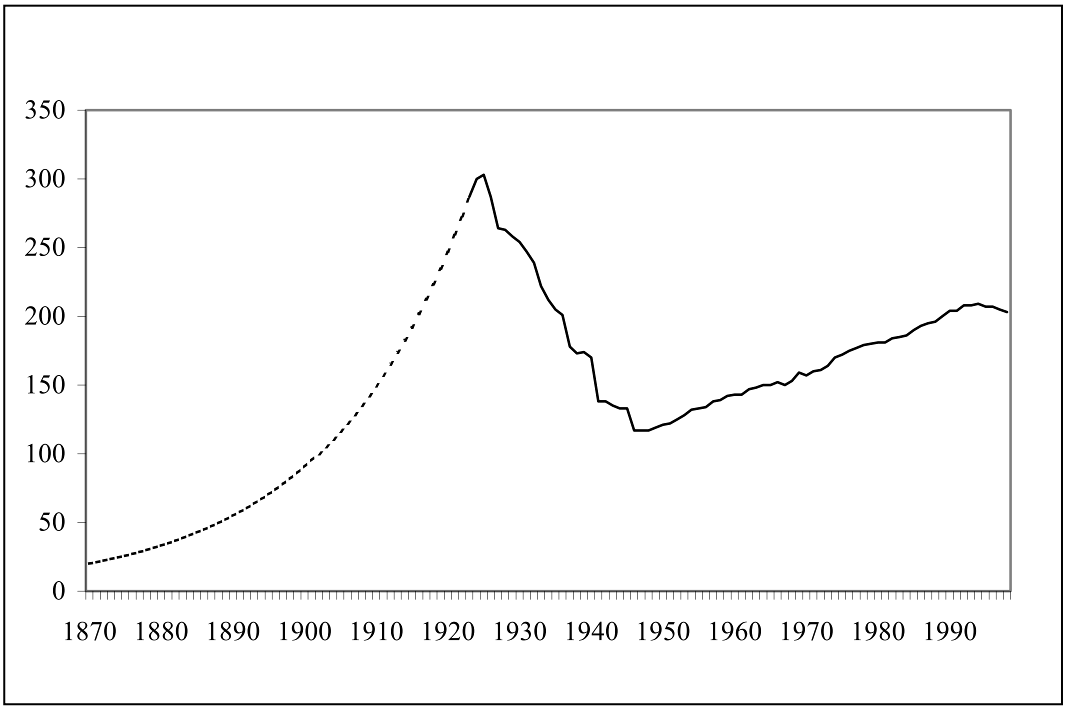
6 Findings

As discussed in chapter 4.2.2, the empirical analysis of the development and the innovation dynamics in the German insurance market comprises two parts. First, we want to identify whether the time period between 1950 and 1998 can be regarded as non-typical maturation or degeneration phase in the insurance specific industry life cycle. Second, we will test the hypotheses on the determinants of the innovation rates in the population of German casualty & property insurance companies based on the negative binomial model.

6.1 Population dynamics in the German insurance market

Figure 6.1 shows the development of the population density in the German casualty & property insurance market between 1870 and 1998.

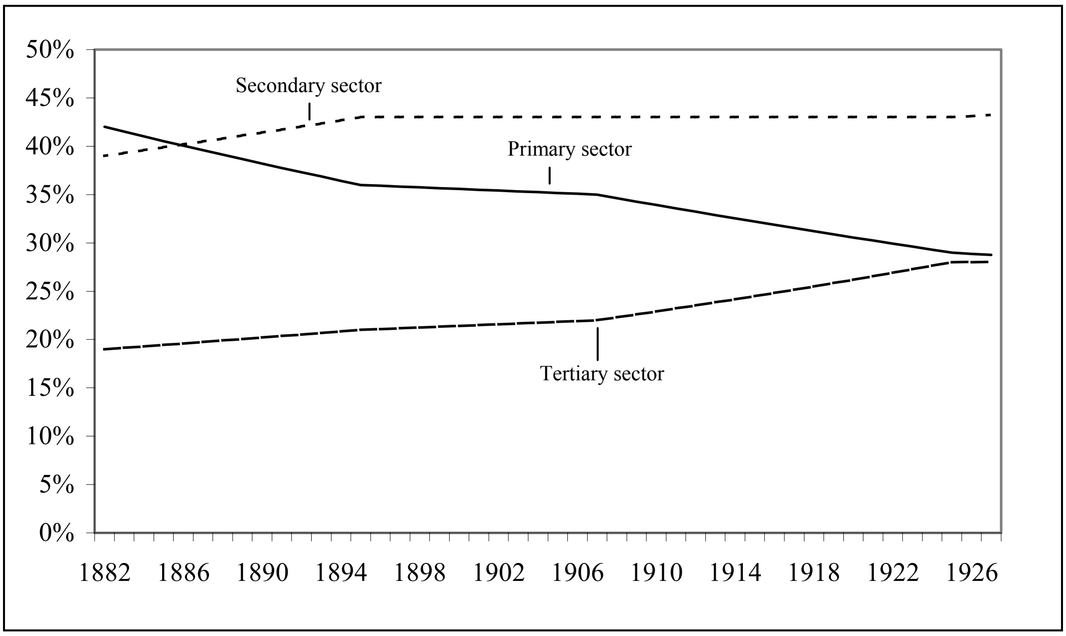
Figure 6.1: Population density of German casualty & property insurance companies[72]



[72] The figure only shows casualty & property insurance companies active in all parts of Germany. Small local population members are not included.

The number of insurance companies in Germany increased significantly between 1870 and the mid-twenties, before it was heavily reduced during a market shakeout between 1926 and 1949. From 1950 to the mid-nineties, the population showed a continuous density growth. However, we have to take into account, that the pattern of the population density until the year 1923 in Figure 6.1 is only estimated, not based on actual values. To the knowledge of the authors, there is no consistent documentation of the population entries and exits for the time period before.[73] Despite this restriction, we can find several indicators in the history of the German service sector and the insurance industry supporting the estimated pattern of the population density before 1923.[74] The tertiary sector globally gained importance in the 2nd half of the 19th century (Fourastié, 1969). This phenomenon also holds true for the economic dynamics in Germany between 1870 and 1925 (Ebersberger et al., 2002). As we can see in Figure 6.2, the development of sectoral employment shows a shift form the primary to the tertiary sector.

Figure 6.2: Development of sectoral employment in Germany, 1882 to 1926[75]



[73] The key source for this analysis, *Neumanns* "Jahrbuch für das Versicherungswesen im Deutschen Reiche" goes back to the year 1903, but only catches parts of the whole classes of insurance in the casualty & property business.

[74] However, it is very likely, that the steady increase of the population density shown in Figure 6.1 was interrupted during and immediately after the First World War. See chapter 2.

[75] Source: Fourastié (1969, P. 112).

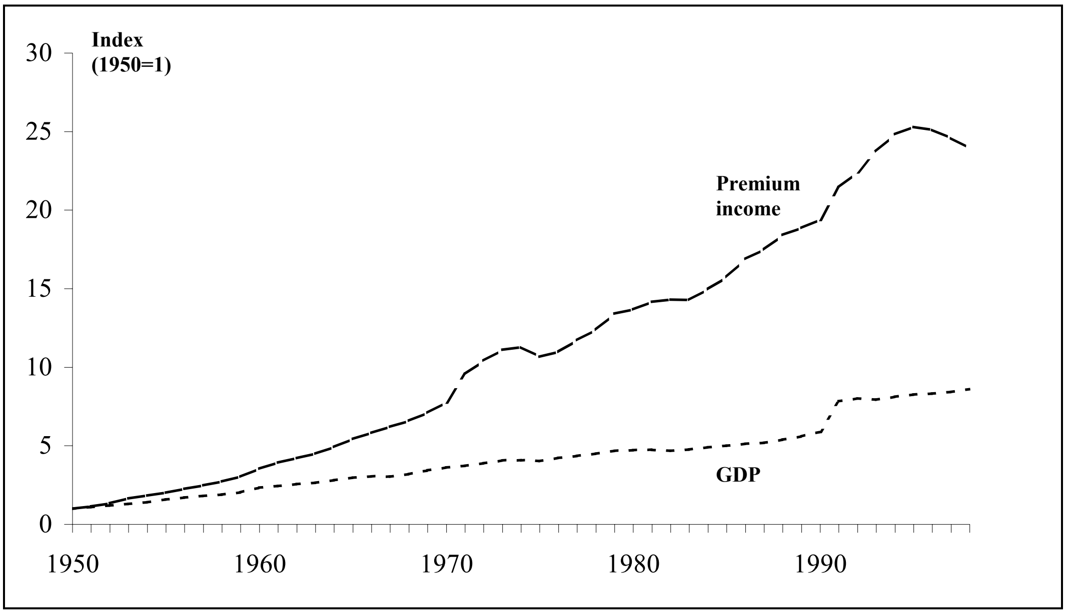
Besides, the industrial revolution generated new objects to be insured and the social legislation by Bismarck in the year 1870 supported the distribution of the insurance idea in Germany. At the same time, several new classes of insurance arose and the idea of a profit-oriented insurance industry was finally established and accepted within the economy and the society. Hence, the pattern of the population density between 1870 and 1923 as shown in Figure 6.1 seems plausible.

In accordance to the standard model of the industry life cycle, a shakeout period began immediately after the density maximum was reached in the year 1925 with 303 insurance companies, which steadily reduced the number of organizations to 117 in 1948. However, we have to take into account, that this development was significantly influenced by fundamental exogenous political and economic shocks. The hyperinflation in Germany in the 1920s first caused an increase in foundings in the insurance industry, but soon led to a wave of mergers and disbandings. Political decisions to centralize the insurance industry by the NS-regime, the economic collapse of Germany in the Second World War and the loss of the East German areas further intensified the market consolidation (see chapter 2). Nevertheless, we can also find indicators for the evolution of a mature market in alignment with the predictions of the industry life cycle. In accordance with Abernathy und Utterback (1978) assuming that the first half of the industry life cycle is dominated by product innovations while in mature and degenerated markets process innovations are more important, in the time between 1870 and 1930 the Germany insurance industry generated most of the fundamental product innovations which still play a major role today. In the time after, the insurance market was characterized by product modifications and process refinements respectively extensions of the product portfolios (see chapter 2).

Having in mind these considerations and remembering the long history of the German insurance industry, it seems valid to claim that the period between 1950 and 1998 can be seen as a phase of maturation and degeneration in the insurance specific industry life cycle. In contrast to the pattern of the standard model, the number of market participants after 1950 did not decline, but rose continuously until the mid-nineties. As we hypothesized in deriving the insurance specific industry life cycle, we see a non-typical development in the maturation and degeneration phase. In chapter 4.2.1, we claim that the development dynamics of the population of insurance companies in the maturation and degeneration phase is determined by the growth rate of national income. Following the concept of the Maslow's pyramid of needs an increase in national income should lead to a higher demand for safety in the society, a development of which the insurance sector can profit more than other branches.

Under the assumption, that right after the Second World War the satisfaction of the basic needs of the people dominated their behavior and that only after the economic recovery in the fifties parts of the people managed to climb form the first to the second level of needs, the concept of Maslow does have some explanatory power regarding the development dynamics of the population of insurance companies. As we can see in Figure 6.3, the premium income and the GDP show a similar pattern between 1950 and 1998. However, the premium income grew stronger than the GDP. Obviously, the branch of casualty & property insurance profited to a high degree from the economic recovery in Germany after the Second World War. At the same time, we know from Figure 6.1 that the number of insurance companies between 1950 and 1998 grew almost continuously. All these observations support the hypothesis, that in this mature market, the economic growth and the development dynamics of the insurance population are strongly correlated.

Figure 6.3: Index of premium income and GDP in Germany[76]



Only the years after 1994 show a slight decline in population density despite an increasing GDP. However, we have to take into account, that this period was influenced by the European deregulation in the insurance industry in 1994, which led to a price war resulting in a high number of mergers and acquisitions, which mainly affected the population of small and local

[76] *Statistisches Bundesamt* (2001, P. 654ff.).

companies, but also had impact on the density in our population of Germany-wide active organizations.[77]

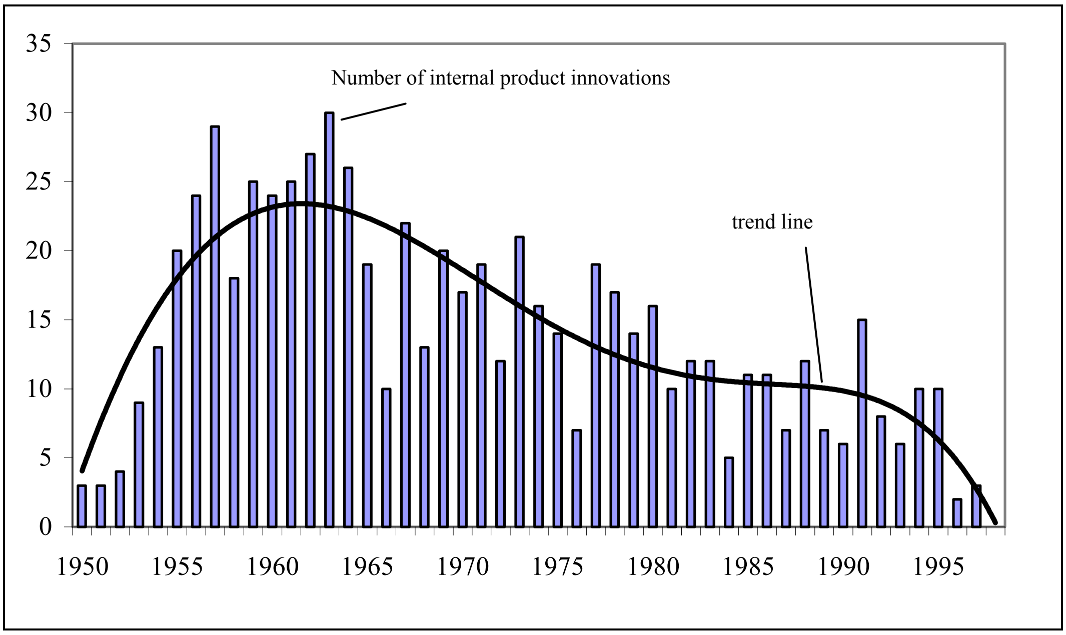
To sum up, the analysis of the density development in the population of the casualty & property insurance companies in Germany yielded two major results. First, the time period between 1950 and 1998 can be regarded as a non-typical maturation and degeneration phase as assumed in the derivation of the insurance specific industry life cycle. Second, the development of the population density in those years is strongly related to the growth of the national income, as forecasted based on the concept of Maslow's pyramid of needs.

[77] Between 1994 and 1998 companies merging consisted above others of the "DBV Deutsche Beamtenversicherungsgesellschaft", the "Winterthur Lebensversicherung AG" and the "Delfin Lebensversicherung AG" (1998), the "Itzehoer Versicherungsverein" with the "Schleswig-Holsteinische Brandgilde" (1997) or the "INTERUNFALL Internationale Unfall- und Schadenversicherungs-Gesellschaft AG" with the "Erste Allgemeine Versicherungs-AG München" (1994). Companies acquired in this period comprised the "Gerling Rechtsschutz Versicherungs-AG" (1998), the "Bruderhilfe Rechtsschutzversicherung" (1998), the "Deutsche Versicherungs-AG" (1998), the "TELLIT Direct Versicherung AG" (1998), the "Württembergische Rechtsschutzversicherung AG" (1997), the "Magdeburger Versicherung AG" (1996), the "Badenia Glasversicherungsverein a.G." (1995), the "Gebäudeversicherung Baden AG" (1995), the "Elektra Versicherungs-AG" (1994), the "Hamburger Phönix Gaedesche Versicherungs-AG" (1994) and the "Skandia Sachversicherung AG" (1994).

6.2 Innovation dynamics in the German insurance market

The analysis of the innovation dynamics in the population of German casualty & property insurance companies focuses on the development of the number of internal product innovations between 1950 and 1998, which can be seen in Figure 6.4.

Figure 6.4: Number of internal product innovations, 1950-1998[78]



In total, we observed 683 such events between 1950 and 1998. After a continuous increase in the number of internal product innovations between 1950 and 1956, the innovation rate reached its maximum between 1957 and 1964 with approximately 25 to 30 market entries per year. In the following years, the trend line of the innovation rate decreased, while the yearly numbers showed cyclical fluctuations. The pattern of the innovation rate immediately after the Second World War is consistent with the expectations considering the historical development of the insurance industry in Germany. Until the mid-1950s, the insurance companies had to restore their infrastructure and assure that normal business in the existing classes of insurance was reestablished (see chapter 2). Diversification through internal product innovations was not yet a dominant strategic option. Only after the legal and economic base for further growth in the insurance industry was given again, the recovery of

[78] Quelle: Eigene Erstellung. Die Trendlinie entspricht einem Polynom fünften Grades und bildet die Entwicklung der Innovationsrate mit $R^2 = 0{,}73$ ab.

the insurance industry also resulted in an increasing propensity to diversify the product portfolios. However, for the remainder of the time period under investigation, historical facts cannot suffice to explain the pattern of the innovation rate. Therefore we turn our attention to the negative binomial regression estimating the effects of population density, prior innovation rates, organization age and size as well as the growth rate of the premium income on the number of product innovations. **Table 6.1** shows the regression results.

Table 6.1: Results of the negative binomial regression, 1950-1998[79]

Covariates	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
Constant	-10,4228** (2,6767)	-2,8732 (2,6611)	-7,0371** (2,9730)	-8,2716** (3,0738)	-9,1910** (3,0028)	-4,6975 (3,0594)	-43,4961** (16,2818)
Density	+0,1742** (0,0329)	+0,0731** (0,0342)	+0,1114** (0,0358)	+0,1226** (0,0365)	+0,1612** (0,0408)	+0,0666* (0,0378)	-0,0649 (0,0868)
Density^2	-0,0006** (0,0001)	-0,0003** (0,0001)	-0,0003** (0,0001)	-0,0003** (0,0001)	-0,0004** (0,0001)	$-8,1*10^{-5}$ (0,0001)	+0,0002 (0,0002)
Prior innovations		+0,0263** (0,0088)	+0,0189** (0,0086)	+0,0187** (0,0085)	+0,0179** (0,0080)	+0,0129* (0,0079)	+0,0048 (0,0114)
ø Premium income			$-6,9*10^{-6}$** ($2,4*10^{-6}$)	$-6,9*10^{-6}$** ($2,3*10^{-6}$)	$-6,4*10^{-6}$** ($2,2*10^{-6}$)	$-9,9*10^{-6}$** ($2,4*10^{-6}$)	$-6,3*10^{-6}$** ($2,6*10^{-6}$)
Growth rate premium income				+1,9826* (1,1537)	+1,9462* (1,0577)	+1,4632 (1,0208)	-2,0401 (0,9006)
% Organizations > 40 years					-3,0724** (1,5607)		
% Organizations ≤ 5 years						+6,8937** (2,0853)	
Age variance							+0,0408** (0,0159)
Age variance^2							$-7,9*10^{-6}$** ($3,2*10^{-6}$)
R^2	0,47	0,60	0,63	0,62	0,69	0,69	0,54
Lags	1	1	1	1	1	1	1

We conduct the empirical test of the hypotheses described in chapter 4.2.2 based on 7 models. In model 1, we only look at the effect of population density on the innovation rate, models 2 to 4 add gradually the other potential determinants. Models 5 to 7 give separate analyses for the influence of the age specific exogenous variables. The quality of the models is measured by the respective R^2. The effects of all determinants on the innovation rate are estimated with a one-year time lag. The results in **Table 6.1** show that except in model 7 adding more explanatory variables generally increases the quality of the estimation.

[79] * p<10%; ** p<5%.

In hypothesis *5* we predicted that if the industry life cycle shows a non-typical pattern in the maturation and degeneration phase, the rate of market entries is solely determined by the general economic development, which is captured through the growth rate of the premium income. The regression results only partly support this assumption. As predicted, models 4 and 5 yield significant and positive coefficients for the variable growth rate of the premium income, but an exclusive determination of the innovation rate could not be identified. All the other exogenous variables tested simultaneously showed a significant influence as well.

Model 7 is the only one not delivering significant coefficients for the effects of population density and the respective squared values.[80] Hence, we can confirm *hypothesis 1* forecasting an inverted U-shaped pattern of the innovation rate in dependence of the population density. Following the results of the negative binomial regression, the model of density dependence commonly used to explain founding and death rates in organizational populations is also transferable to the innovation dynamics in the population of German casualty & property insurance companies.

However, we have to be careful in also copying the interpretation underlying the model of density dependence in the case of founding and disbanding dynamics. In the original concept of Hannan (1986), the level of legitimation of an organizational form rises with the number of population members and leads to higher founding rates further increasing population density, so that more intense competition reduces the rate of organizational foundings and causes more disbandings. In our case, the occurrence of the event "internal product innovation" does not change the density of the population. We look at the entry of already existing organizations into the diverse sub-markets of the industry. Hence, legitimation processes do not affect the rate of acceptance of a specific organizational form, but of the diversification of the product portfolio as a commonly accepted strategic direction.

At the same time, increasing competition within the population can have positive and negative effects on the rate of internal product innovations generated. A higher number of competitors forces the existing organizations to search for ways to differentiate from the remainder of the population. One way for differentiation is the generation of an internal product innovation. On the other hand, the probability of success of an internal product innovation will be higher, the less other companies have already seized the market and developed a market reputation that cannot be easily copied by new entrants. The inverted U-

80 Model 6 shows a significant value for the effect of density, the coefficient for density^2 however, is insignificant.

shaped pattern of the innovation rate according to the results of the negative binomial regression indicates, that up to a certain density, the positive effects of legitimation of the diversification strategy and innovation due to the need to differentiate have dominated the innovative behavior of the population members, before negative competition effects reduced the number of innovations generated.

Similarly, the results regarding *hypothesis 2* assuming a positive effect of prior innovations on the future rates, can be confirmed in all tests of the negative binomial regression except model 7. Obviously, a high innovation rate was interpreted as an indicator for favorable environmental conditions for market entries and led to an imitation of the diversification strategy in the following year, while decreasing innovation rates also diminished the future propensity of population members to generate product innovations. However, the database showed that there is no such thing as the typical "pioneer" company in terms of diversification in certain sub-branches. The first organizations to diversify into the several classes of insurance between 1950 and 1998 built a very heterogeneous group consisting of small and large, young and old companies. The only consistent trend observable was that almost all "pioneers" already had diversified into other classes of insurance before. Obviously, the specialist companies first waited until the probability of success of diversifying in a specific class was clear and then imitated the "pioneers".

While the small companies were not the first to follow a diversification strategy, *hypothesis 4* assuming a negative relationship between organizational size and the innovation rate still was confirmed in the negative binomial regression. The variable "average premium income" yielded significant negative coefficients in all models tested. This result seems to be counter-intuitive having in mind the specific characteristics of the demand for insurance products discussed in chapter 3, which tend to favor companies with large sales organizations and a broad market presence in the process of implementation of a product innovation. However, large organizations often already have satisfied their diversification needs. On average, the 20 largest companies in the population offered products in 11,7 classes of insurance, whereas the 20 smallest organizations only were active in 3,5 classes. Apart from the lower need of large organizations for further diversification, they also can choose between different alternatives to enter a new market. Instead of creating an internal product innovation they might as well buy a smaller competitor that already acts in the market of interest.

Similar arguments can be brought forward in explaining the effect of organizational age on the innovation rate. The importance of the market reputation of an insurance company when entering a new market[81] would lead to the assumption that older organizations would generate a higher number of product innovations. However, the coefficients of the share of over 40 old companies yields a significantly negative value, whereas the percentage of organizations which are 5 years old or younger obviously have a significantly positive influence on the innovation rate. The relationship of the innovation rate and the age variance follows a inverted U-shaped pattern, similar to the effects identified for the population density. Hence, *hypothesis 3* is generally supported in the negative binomial regression.[82] Once again, the higher structural inertia of the older insurance companies can have several reasons. They might have gone through diversification processes in younger years[83], or they might be specialists form their founding on and traditionally do not intend to diversify their product portfolio.[84]

7 Conclusion

Although the long-term evolution of industries has been on the agenda of economics since the early 20th century (Schumpeter, Kuznets, Clark) this tradition is almost neglected since the mid 1950s when industrial economics became embedded in the so-called Structure-Conduct-Performance-Paradigm. However, since the 1980s a branch of literature emerges dealing again with the phenomenon of long term developments driven by technology dynamics and innovation. On the one hand, population ecology is transferring concepts of evolutionary biology on sector development. On the other hand, the so-called theory of industry life cycles is focusing on cyclical phenomena during the period between the emergence and maturation of industries.

[81] See chapter 3.

[82] An increase in the age variance indicates a trend of rejuvenation in the population. The effect of this variable on the innovation rate is non-monotonic. The number of internal product innovation rises until a certain value of age variance, after which the negative effect dominates. The first part of this effect is consistent with the results of the other age specific exogenous variables. But if the population consists mainly of very old and very young companies and the age variance therefore exceeds a certain value, then the competitive advantages of old and experienced companies obviously play a major role and the market entry of younger competitors via product innovations becomes more difficult.

[83] Organizations that are five years old or younger offer products in 3,8 classes on average, companies older than 40 years 6,8 classes.

[84] Such specialist organizations are for example the "Gartenbau-Versicherung VVaG" in Berlin (founded in 1847), the "Kölnische Hagel-Versicherungs-Gesellschaft" (1853), the "Union Actien-Gesellschaft" in Hamburg (1857), the "Pfälzische Viehversicherung VaG" in Ludwigshafen (1849) or the "Union, Allgemeine Deutsche Hagel-Versicherungs-Gesellschaft" in Hamburg (1853).

This paper is an attempt to transfer basic ideas of both theories to the service industries, in particular the insurance market and to test hypothesis concerning the origins and mechanisms of the dynamics observable there. It is shown that an one to one application of these theories which were constructed having in mind manufacturing industries is not possible. However, referring to the special features relevant for service industries and in particular insurance industries allows the derivation of modified hypothesis concerning the observed industry dynamics which empirically can be tested. The patterns of market entry, exit and innovation observed in the German insurance industry follow predictions made by both theoretical approaches.

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