Demand for Statutory Health Insurance in Germany

1996 to 2002 following the Deregulation in the 1990s

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To my Parents

ABSTRACT

VOLKER GRZIMEK: Demand for Statutory Health Insurance in Germany 1996 to 2002 following the Deregulation in the 1990s
(Under the direction of John Akin and Helen Tauchen)

In this dissertation I identify the source(s) of price setting power in the German statutory health insurance system. To accomplish this I construct a self compiled firm level data set with detailed information on membership, price and non-price attributes. For each of the three potential sources of price setting power, search costs, switching costs and product heterogeneity, I develop an empirical model that is designed to evaluate each potential source individually.

I then estimate these models separately using ordinary least squares, fixed effects and dynamic panel data methods while controlling for endogeneity, heteroskedasticity and autocorrelation. The individual results suggest that both switching and search costs are potential sources of price setting powering this market, while non-price attributes are found to have no significant impact on sickness fund size.

Finally a joint estimation of the models confirms that product heterogeneity can be rejected as potential source. The results also strongly support the hypothesis that switching costs are the major source without ruling out that search costs play a secondary role.

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This journey has taken a long time. I know I will never write another dissertation again, but I am confident that I will also never regret to have done it once.

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1 Introduction

This research focuses on the effects of the 1996 deregulation of the German statutory health insurance market on the demand for health insurance. Even though the insured are allowed to choose their sickness funds (insurer) freely within their market and contribution rate (price) heterogeneity across funds proves to be very persistent, only about 3 % of the insured switch every year, despite large potential savings of up to several hundred Euros per year. This research seeks to identify the source of contribution rate setting power that explains the low rate of switching. Different estimation approaches allow testing product heterogeneity, switching costs and search costs as potential sources of contribution rate setting power[1] when estimating sickness fund membership.

This research uses a self-compiled data set of individual sickness fund data for 1996 to 2002 that is richer in scale and scope than any of the data used in earlier research on demand for sickness funds. This data set is the first to include extensive information on each fund's market of operation, competitors' prices and non-price attributes. The latter are added to the data set by merging the self-compiled data set with published surveys of funds' non-price attributes, which allows the removal of potential omitted variable bias. The estimation techniques used in the data analysis control for heteroskedasticity, serial autocorrelation and endogeneity.

[1] Limitation on entry and exit would be a fourth potential source of contribution rate setting power, but is not relevant in the German sickness fund sector.

This research is organized as follows: In Chapter 2, the German health insurance sector, its history, the actors and the reforms of the 1990s are described. In Chapter 3, the relevant literature on health insurance demand is reviewed. In Chapter 4, a model of insurance demand that fits the characteristics of the German health insurance system is developed and its components discussed, followed by a discussion of the different sources of contribution rate setting power in Chapter 5. In Chapter 6, the data set is described, and Chapter 7 details the statistical analysis and discusses the findings. Finally in Chapter 8, the most important results of this research are summarized, and the implications of this study and the need for future research will be discussed.

2 The Health Insurance System in Germany

2.1 History of the German Health Insurance System

Germany became the first country worldwide to codify existing voluntary structures of health insurance into a mandatory state-supervised system in 1883.[2] A network of voluntary sickness funds existed before 1883, which was mostly organized around guilds, communities or companies[3], whose recorded origins reach back to the fourteenth century.[4] The main purpose of these early forms of insurance was to prevent the extreme poverty that often resulted from sickness and disability. Early companies also set up funds as a fringe benefit to retain qualified workers. As workers became eligible for coverage only after a certain amount of employment seniority and lost coverage when they were switching employers, these funds helped to keep turnover low.[5]

The "*Gesetz betreffend der Krankenversicherung der Arbeiter*" (law concerning the health insurance of the workers) of June 15th, 1883, was the first law to codify mandatory health insurance and is usually associated with Chancellor Otto von Bismarck who actually favored a system were the insurance provider would have been public entity.[6] The resulting system was a compromise between supporters and opponents of public intervention and defined the four major elements of the current system:

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[2] Saltman and Dubios (2004)
[3] Riesberg and Busse (2003)
[4] IKK (2003)
[5] BKK Baden-Württemberg (2002)
[6] BKK Baden-Württemberg (2002)

- mandatory membership
- mandated coverage catalogue
- liability of the employer for payment of the premium, which is a certain percentage of the income (contribution rate) paid via payroll deduction
- self-governance of the funds.[7]

The new system followed the principle of social insurance (the only criterion for participation in the system being insurance-eligible employment), subsidiarity (expressed through the system's self-governance) and solidarity (premiums depend on income instead on actuarial risk and family members are covered free of charge) that still characterize the system today.[8]

Initially the new law covered the industrial workforce, which was only a small share of the population. In 1885, 10% of the population was covered by one of 18776 sickness funds, as compared to 5% before the reforms took place.[9] The share of the insured population increased steadily in subsequent decades to 51% in 1925 and to between 80% and 90% since World War II.[10] The steady increase was caused by the gradual inclusion of a number of trades and subgroups of the population. Most notably were the inclusion of the unemployed in 1917/1918, retirees in 1941, farmers in 1972 and students in 1975. The last groups to be included were artists and publicists in 1981.[11] The number of funds kept increasing until the 1910s when about 22000 funds operated in Germany and declined ever since to 253 on January 2006.

[7] IKK (2003)
[8] Amelung, Glied and Topan (2003)
[9] Bärnighausen and Sauerborn (2002)
[10] Riesberg and Busse (2003)
[11] See Bärnighausen and Sauerborn (2002) for a comprehensive timeline of the expansion of the German statutory health insurance system.

Monetary benefits like wage replacement and death benefits that dominated the benefit structure in early years became of lesser importance over time. Non-monetary benefits like payment for health care provider services now constitute the major part of the sickness funds' expenditures. In 1885 the ratio of monetary benefits to non-monetary benefits was 1.7 to 1. In 1960 this ratio had already fallen to 1 to 4 and in 2000 it reached to 1 to 13.[12]

Two more pillars of social protection were instituted in Germany in the decade following the implementation of the health insurance system. Insurance against labor related accidents and invalidity and the public pension system were introduced in 1884 and 1889 respectively. The fourth pillar followed during the Weimar Republic (unemployment insurance in 1927). The fifth and as of yet final pillar, the mandatory nursing care insurance (which is carried out by the providers of statutory health insurance) was legislated much later in 1994.[13]

Before the Third Reich, several reforms took place that shaped today's mandatory health insurance system. The Berlin Treaty of 1913 granted the physicians more rights to influence the accreditation and compensation of licensed physicians. Initially the individual funds had contracted a provider network of ambulatory and stationary care as well as even individual pharmacies. New regulations in 1931 and 1932 established the free choice of health care provider that is still in existence today. These reforms also led to the formation of physician's organizations, which are still a major player in today's system.[14]

The National Socialist government considered centralizing the fragmented structure of the sickness fund system with its tens of thousands of players in 1934, but finally decided against it. However, the Nazi regime undermined the principle of self-governance by

[12] Riesberg and Busse (2003)
[13] Riesberg and Busse (2003)
[14] BKK Baden-Württemberg (2002)

appointing sickness fund leaders who were loyal to the regime. Among the other reforms they implemented was a greater financial oversight through the regional social insurance authority, which is still in place today.[15]

The decade following the war saw a restoration of most of the pre-Nazi system of fund independence and self-governance. Health care costs (and thus contribution rates) rose during the 60's and 70's, due to more extensive use of technology, more comprehensive coverage and rising personnel costs.[16] Following the first oil price shock in 1975, the German Parliament passed the Health Insurance Cost Containment Act of 1977 that required the insurance and health care providers to pursue the goal of stabilizing the contribution rates. The contribution rate stabilization has been the target of cost containment ever since.[17] Further legislation, indented to contain costs, followed in 1979, 1981 and 1984.

The "*Gesundheitsreformgesetz*" (Health Care Reform Act) of 1988 aimed at further cost containment and improved preventive care.[18] The 1988 reform expanded co-payments for pharmaceuticals, transportation and statutory care, excluded comfort drugs from coverage and increased efficiency audits. Other features of the reform were the implementation and expansion of preventive measures, early diagnosis and health promotion. The reform of 1988 helped to reduce health care expenditures significantly in the following two years, allowing the contribution rates to decline. However, the reform's cost saving impact faded in the early 1990s when the expenditures started to rise faster than the average income, causing the contribution rates to increase again.

[15] BKK Baden-Württemberg (2002)
[16] One reason for the rising personnel costs was the secularization of many hospitals.
[17] European Observatory (2000)
[18] The 1988 and following reforms are described in more detail in BMFG (2002-1).

This increase prompted the German Parliament to pass the "*Gesundheitsstrukturgesetz*" (Health Reform Act) of 1992. Here, the only features of the act presented are those that are not related to increased insurance choice or the implementation of the risk structure adjustment scheme, both of which will be discussed in detail in the following chapters. To prevent further increase of the contribution rates, the percentage increase of expenditures was limited to the percentage increase of the incomes that were subject to contribution rate payments for the period from 1993 to 1995. Hospital financing underwent major reforms and the system switched from a full-cost to a performance-related reimbursement system. Hospitals were now also allowed to perform pre- and post-stationary treatments and ambulatory surgery. Reimbursement for dental care was capped and free dental treatment for the young became limited to include only basic procedures. Volume limits for prescriptions and further co-payments were implemented. The requirement planning and licensure of sickness fund-accredited physicians underwent major changes to optimize supply. The reform of 1992 achieved major cost savings that led to lower contribution rates over the next years, but by 1996 the increase in medical care costs started to outpace the income growth again and thus the contribution rates started to rise again.

Therefore in 1996 the German parliament passed the "*Beitragsentlastungsgesetz*" (Contribution Rate Reduction Act), which increased all co-payments. For the first time the lawmakers directly interfered with the fund's right to set the contribution rates by ordering all funds to decrease the contribution rates by 0.4 percentage points in January 1997.[19] All future contribution rate increases by a fund were also to trigger an automatic increase in the co-

[19] Apparently not all funds complied with this law for unknown reasons. Also many funds increased the contribution rate in December 1996 by exactly this 0.4 percentage points.

payments for that fund's members as well. In 1999, the new government[20] abolished these dynamic co-payment rules and some of the dental care rationing. Further reforms that aimed at cost containment followed in 2000, 2002 and 2004, but since they have no impact on the timeframe of this research, they are not discussed here in further detail.

2.2 The Supply Side of Health Insurance

The German health insurance system rests on two pillars – the private and the statutory sickness fund systems. While the private sector, consisting of some 20 different insurance companies, includes many of the features found in the U.S. insurance system, systems similar to the statutory system are only found in a few other countries like Switzerland and the Netherlands.

The statutory sickness fund sector as a whole is a major player in the German economy. The total contribution rate revenue accounts for 6.4% of the German GNP.[21] The sickness funds are organized as statutory non-profit organizations. They are characterized by a large degree of self-governance, but supervised by state and federal authorities. Their supervisory boards are composed of representatives elected by its members or, for some types of funds, by representatives elected by both the firms that are backing the funds and the members. The legal framework for the funds as well for the other players in the system is set in the Social Code Book V.[22] The Social Code Book V defines the scope of the benefits package (chapter 3), the organizational structure of the sickness funds (chapters 6 and 7) and

[20] A coalition of the Social Democratic Party and the Green Party replaced the coalition of the Christian Democratic Party and Liberal Democratic Party in 1998.
[21] Berié and Fink (2003)
[22] The full inclusion of the laws regulating the statutory health insurance system into the Social Code Book was part of the reforms of 1988.

the fund's financing mechanism (chapter 8). The Social Code however defines only the goals and scope of the interaction of funds and health care providers (chapter 4) and leaves it to the players within the system to negotiate the specifics.[23] Often, however, the lawmaker reserves the right of further regulations, in case the funds and health care providers fail to fulfill the legally mandated goals.[24]

The funds' non-profit status places limits on the amount of debt and reserves that the sickness funds can hold.[25] If a fund's reserves exceed or fall short of the legal limits, the fund has to adjust the contribution rate accordingly. Funds set the contribution rate as a percentage of income[26], up to a legally mandated compulsory insurance contribution ceiling. The funds set three different contribution rates, one (general) for members with the regular sick pay arrangement (employer pays sick pay for the first six weeks and the fund thereafter), one for those without the need for sick pay (reduced rate) and one for those members without employer paid sick pay for the first 6 weeks (increased rate). The employed members (and retirees) pay half of this contribution rate by payroll deduction and the employers (and public pension funds) pay the other half. The self-employed are responsible to pay the premium themselves and the labor office pays for the unemployed. Students pay a fixed monthly premium that is uniform across funds.

The compulsory insurance contribution ceiling is set annually by the federal government and increases at the growth rate of average income. The responsible federal or

[23] European Observatory (2000)
[24] This provision was included in the 1992 reforms when the lawmakers learned from past experience that they need a mechanism to interfere quickly if the actors within the system of self-governance fail to agree on procedures that give the desired results. BMFG (2002-1)
[25] The reserves have to be between 25% and 100% of the monthly expenditures. (SGB 5 § 261)
[26] The exact definition of "income" is not necessarily the same as for taxation purposes. A discussion of the exact rules and regulations would be too extensive here. Generally the financial ability is the guidance for the computation of the relevant "income". The individual funds have a certain leeway in the definition of "income" of their voluntary members (SGB 5 § 240).

regional social insurance authority has to approve every change in the contribution rate. Until 2001 the funds set the contribution rates individually in the old and new states, and operated in each part of Germany as a different accounting entity.[27] Ever since 2001, the funds operate as one accounting entity nationwide and charge the same rate in both parts of Germany. There is some discussion in allowing funds to differentiate their contribution rates by region. Some regions (e.g. the city states of Hamburg, Berlin and Bremen) have higher average health care costs than more rural regions. Therefore the mix of markets in which a fund operates impacts the fund's required contribution rate and therefore competitiveness.[28] To a limited degree funds were allowed to experiment with premium refunds, deductibles and co-payments.[29]

The funds cannot reject any applicant who is lawfully eligible to become a sickness fund member. The coverage package that funds are required to offer is 95% to 98% homogenous[30] and includes comprehensive ambulatory and stationary care, prescription drugs (with a small co-payment), most dental and eye care, and sick pay.

For traditional reasons, the funds are distinguished by type (see Table 1 for an overview of the number of each type by year). Even today the distinction matters somewhat, because the type determines the composition of the supervisory board, and whether the fund has the choice to be an open fund, which means that the fund has to accept any applicant

[27] The former East Berlin, now part of the State of Berlin became part of the "new States" category in 1995.
[28] Esbsen et.al. (2003), Wasem, Jacobs and Reschke (1998) and Jacobs, Reschke and Wasem (1998).
[29] There exists very limited information about the scale and scope of these projects. Therefore it is believed that these programs were sufficiently small and unimportant and that their omission does not to influence the results of this research. Finanztest (1998) lists four funds that offered deductibles or co-insurance schemes and two that offered a premium refunds. Focus (2000) reports of nine funds that offered refunds for participants in provider panels.
[30] Different sources report these slightly different numbers. No source reports how they derived the exact number, which is therefore assumed to be arbitrary, and to mean "almost completely".

living or working in a defined geographic, or a closed fund, which allows the fund only to accept members working in one of the companies that are backing the fund.

Table 1: Number of Sickness Funds from 1970 to 2004 by Type of Fund

Year	All Funds	AOK Regional Funds	BKK Company Funds	IKK Guild Funds	EK Substitute Funds	Other
1970	1815	399	1119	178	14	105
1980	1319	272	855	157	14	21
1990	1147	267	692	152	14	22
1995	960	92	690	140	14	24
1996	642	20	532	53	14	23
1997	554	18	457	43	14	22
1998	482	18	386	43	13	22
1999	455	17	361	42	13	22
2000	420	17	337	32	12	22
2001	396	17	318	28	12	21
2002	355	17	287	24	12	15
2003	330	17	267	22	12	12
2004	298	17	238	21	10	12

Source: VdAK (2004)

The AOKs traditionally insured most blue-collar workers that were not forced to be a member in a BKK or IKK. The AOKs are amongst the largest funds in Germany. They operate in one region (state) only and each AOK usually has the largest market share of any fund in its respective market. 17 AOKs exist today, 15 in states with one AOK each and two in North Rhine-Westphalia, each covering about half the state. The geographic area in which an AOK operates defines the market for which the IKKs and BKKs have to decide whether to be open.[31] The 1992 reform mandated every AOK to be open in its region in 1996. The AOKs are usually the funds in each market with one of the highest contribution rates.

[31] For example before the two AOKs in Saxony-Anhalt merged to one state-wide AOK, IKKs and BKKs could either compete openly in one of the two regions within Saxony-Anhalt or in both.

The BKKs were set up by one or several companies and previously insured only the employees of these companies. Since 1996 every BKK has the choice to remain closed to outsiders or to open itself for any (AOK defined) market in which the backing company (or companies) maintain a branch. By now, the majority of BKKs have opted for the open status. The decision for the open status is irrevocable.[32] The BKKs are the largest group of funds (see Table 1). The size of the BKKs ranges from very small one-firm funds (usually closed) with about 1000 members to open BKKs that are set up by large firms or multiple firms that operate in the whole country and have over 1 million members. Since the number of mergers has exceeded the number of new foundations of BKKs during the last couple of years, the number of BKKs is decreasing rapidly.

The IKKs (guild funds) were founded by the guilds. Originally these funds insured all employees of firms that were organized in a guild. The reform of 1992 gave the IKKs the same rights and imposed the same rules as on the BKKs. The number of IKKs declined over the last several years as they first started to merge across professions and later across regions. By 2002 most of them covered an entire state and some operated in several states, often even competing with each other.

The EKs (substitute funds) used to be either the alternative choice for some white-collar workers (EKAng) or, to a more limited degree, blue-collar workers (EKArb). Some of them are among the largest funds in Germany, but their market share (measured in the market of operation) is usually lower than the share for the AOKs, since most EKs operate in the whole country while the AOKs are focused on one market only. As of 1996 all EKs have to be open and there have been relatively few mergers between EKs.

[32] Greß (2004)

A few other funds exist for miners, farmers and seamen. These are regulated differently and don't compete with the other funds. Employees in these professions still cannot choose their funds freely and are mandatory members of the fund covering their profession.

The number of funds decreased from 642 in 1996 to 253 in 2006. Most of the decrease was caused by smaller funds either merging with larger funds or merging with several other small funds to form a larger new fund. Closures are also possible, but happened very rarely as a financially distressed fund's federal or state association is responsible for helping its membership funds.[33] Funds that were threatened by bankruptcy usually merged with a larger fund.

Table 2: Membership by Type of Fund from 1996 to 2002

Type of Fund	1.1.1996	1.1.2002	Total Change	Percentage Change
AOK	22,146,745	19,182,242	-2,964,503	-13.39%
BKK	5,218,475	8,916,736	3,698,261	70.87%
IKK	3,000,151	3,139,261	139,110	4.64%
EK	21,276,569	17,954,015	-3,322,554	-15.62%
Other	1,887,027	1,770,578	-116,449	-6.17%
ALL Funds	50,828,967	50,962,832	133,865	0.26%

Source: Official Statistic KM1 of the Bundesministerium für Gesundheit

The period of interest for this research saw major changes in the distribution of members across funds. Between 1996 and 2002 the BKKs' membership increased by 71.9% and the usually more expensive AOKs and EKs lost 13.4% and 15.6% of their membership respectively (see Table 2).

[33] For example the AOK Berlin received transfer payments from all other AOKs for several years.

The Health Reform Act implemented a risk structure adjustment (RSA) across funds starting in 1994.[34] The objective was to decrease the large variation in contribution rates across funds that was caused by the unfavorable risk structure of some BKKs and most of the AOKs that insured an disproportionately large percentage of elderly and sick. The RSA determines a "fictional contribution rate" that would have to be charged to cover the mandatory coverage expenditures of all sickness fund members in Germany given the total income that is subject to contribution payments of all members. The expected medical expenditure is then computed for all insured controlling for age, gender and disability status[35] and for each fund the financial requirement given the composition of the fund's members is computed. The financial requirement is finally compared to the "fictional revenue" that the fund would receive if it charged the "fictional contribution rate". If this "fictional revenue" is larger than the financial requirement, the fund has to contribute the difference to the RSA, if it is lower, it will receive the difference from the RSA. The RSA does not free the funds from the financial risk of providing insurance, because the actual expenditure does not impact a fund's position within the RSA. Even though initially the RSA was supposed to potentially phase out at some point in the future, the persistence of a heterogeneous risk structure across funds requires the RSA to remain in place for the foreseeable future. Reforming the RSA is a hotly debated and deeply researched topic, because the RSA is redistributing billions of Euros annually.[36] The main debate circles around the appropriate way to compute the financial requirement.[37] The RSA has undergone three reforms since its implementation. In

[34] See Ramm (Unknown) for an excellent overview of the functioning of the RSA and the reforms that will be implemented over the next years.
[35] Which results for every insured to belong to one of 732 different "risk cells".
[36] For reform proposals and further discussion of the "optimal" RSA see Breyer and Kifmann (2001), Lauterbach and Wille (2001) and Jacobs, Reschke, Cassel and Wasem (2001).
[37] For example whether to include a switcher component since switchers seem to incur lower health expenditure than non-switchers. Alternative models ask for the inclusion of morbidity based indicators.

1995 retirees were included in the RSA. In 2001 the RSA for the new and the old states merged to one all-German RSA. The latest reform in 2002 refined the RSA by adding a high-risk pool and special redistribution rules for expenditures for chronically ill, thus removing some of the insurance risk from the individual funds.

2.3 The Demand Side of Health Insurance

In 1999, the sickness funds insured about 88.4% and the private sector about 8.9% of the population. About 2.4% of the population had some other form of coverage and only 0.2% of the population had no coverage at all.[38] Coverage in the sickness fund system is mandatory for all employees with an income below an income threshold for compulsory insurance, which is adjusted annually according to the average income growth.[39]

If a member's[40] income exceeds this threshold, he can remain a voluntary sickness fund member or leave the sickness fund system and seek coverage in the private sector or remain uninsured. Anyone insured in the private sector can generally not switch back to the sickness fund system, unless his income falls below the aforementioned threshold. Even in this case sickness fund membership is often only temporary. To obtain the right to remain in the sickness fund system as a voluntary member after an income drop and a subsequent increase back above the threshold for mandatory membership, the income has to be below the threshold for a certain amount of time.[41] Some subgroups of the population (mainly civil

[38] BMFG (2002)
[39] 3375 Euro in 2002. Until 2003 both the compulsory insurance contribution ceiling and the income threshold for compulsory insurance were identical. Now the latter is somewhat higher widen the basis of high-income members in the sickness fund system and to further lower the outflow of members to the private sector.
[40] "Members" of sickness funds are the primary policyholders and "insured" are the members plus their dependents that are covered free of charge.
[41] This way the lawmaker tries to avoid that privately insured can abuse the system by switching back by intentionally dropping their income below the threshold for a short period of time. The exact rules changed

servants and self-employed) must choose their system once and cannot switch systems thereafter. Therefore only a relatively small number of people can even switch between the two systems.[42] About 4.5 million sickness fund members also purchase supplementary private insurance coverage, which is provided only by private insurance companies.[43]

Dependants of members of a sickness fund are covered free of charge as long as they are not employed and therefore mandatory members themselves. Students have the option to join a fund or to seek private coverage. All unemployed become mandatory members.

In 2002 (see Table 3), 13% of all members were non-retiree voluntary members and 57% non-retiree mandatory members. 30% of all members were retirees. 28% of all insured were dependents. 85% of all members were paying the "normal" contribution rate.

The early 1990s saw the need for reform of the health insurance system for several reasons. The main factor that led to the introduction of the free choice of health insurance providers in 1996 was that the discrimination between blue-collar and white-collar workers did not seem seasonable anymore. The efficiency benefits of increased competition were only a secondary reason for the reform.[44]

Before the 1996 reform, fund choice was extremely limited.[45] Blue-collar workers had to be insured in either a primary fund which was either their company's BKK or a guild based IKK. If there was no such fund, they had to be a member of the local fund (AOK). Only about 20 % of the blue-collar workers had a choice to be insured in one of the eight

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several times over the last years. The Health Care Reform Act of 2000 explicitly removed the right for anyone 55 years and older to permanently return into the sickness fund system.

[42] About 300,000 persons previously insured in a sickness fund switch annually to the private sector and about half that many switch in the opposite direction.

[43] Supplementary coverage often includes full coverage for glasses, being treated by the head physician of a hospital, single hospital room, full dental coverage, etc.

[44] See Schut, et al. (2002) and Reiners (1993)

[45] There is limited information about the exact switching and choice rules prior to the reform available

blue-collar EKs, which were available only in certain regions or trades.[46] White-collar workers faced the same rules regarding their primary funds, but often had several EKs to choose from. 68% of the employees that were classified as "white-collar" (which were about half of the work force) were members of an EK. The popularity of the EKs was usually explained by the perception that the substitute funds offered better service and were more lenient in approving certain treatments (like stays in health spas). Another explanation for the substitute fund's popularity is the fact that by being in a white-collar substitute fund displays one's higher status in society.

Table 3: Enrollment in Sickness Funds by Type of Fund 2002

Type of Member	AOK	BKK	IKK	EK	Other	All Funds	Percent of Total Members	Percent of Total Insured
Mandatory Members	10,129,444	5,636,919	2,278,131	10,504,674	455,229	29,004,397	40.96%	56.91%
Voluntary Members	1,310,871	1,317,632	288,889	3,632,557	84,319	6,634,268	9.37%	13.02%
Sum without Retirees	11,440,315	6,954,551	2,567,020	14,137,231	539,548	35,638,665	50.33%	69.93%
Retirees	7,741,927	1,962,185	572,241	3,816,784	1,231,030	15,324,167	21.64%	30.07%
Sum all Members	19,182,242	8,916,736	3,139,261	17,954,015	1,770,578	50,962,832	71.97%	100.00%
Covered Family Members	6,899,886	3,740,115	1,327,080	7,208,340	676,318	19,851,739	28.03%	
Sum all Insured	26,082,128	12,656,851	4,466,341	25,162,355	2,446,896	70,814,571	100.00%	
Normal Contribution rate	14.28%	12.96%	14.18%	14.30%	13.11%	14.00%	% of Total Members w/o Retirees	
Increased Contribution rate	17.47%	15.43%	15.76%	15.66%	14.60%	16.03%		
Reduced Contribution rate	12.96%	12.25%	12.63%	13.37%	11.18%	13.04%		
Non-retiree Members paying "normal" contribution rate	9,938,630	6,403,617	2,289,311	11,647,499	148,043	30,427,100	85.38%	
Market Share (all Members)	37.64%	17.50%	6.16%	35.23%	3.47%	100.00%		
Market Share (all Insured)	36.83%	17.87%	6.31%	35.53%	3.46%	100.00%		

Source: BMFG KM1 January 2002

Starting in 1996 any member of a sickness fund could choose among several sickness funds. The new rule allows each person to choose any one of the following options: a) the AOK in the region of residence or employment, b) any "open" IKK or BKK that operates in

[46] Thus the choice was often only between their primary fund and one of the EKs.

the region of residence or employment, c) any EK, d) the IKK or BKK of one's employer, e) the spouse's fund or f) to remain in the current fund even if none of a) to e) applies anymore.

The new switching rules allow every sickness fund member to cancel the membership with his sickness fund by October 1st of any year and to join a new fund by the following January 1st.[47] Additionally, if a fund decides to raise its contribution rate, any member of that fund can cancel the membership within two months and join another fund. Voluntary members are not bound by the October deadline and can cancel their fund membership anytime with two months notice. Beginning in 1996, retirees had the same switching rights as everyone else, but less incentive to do so. Until mid-1997 the contribution rate for retirees were equal across funds. Since then retirees face the same contribution rate as the other sickness fund members, but for the retires the contribution rates set January 1st is frozen for the remainder of the year.

[47] As of last year the rules are modified since, according to the government, there is some excessive switching. Now a switcher is tied to his new fund for 18 month after which he can switch again with three-month notice. The switching rules for members of funds that increased their contribution rate remain in effect. This if of no consequence for this research as the changes to the rules occurred after the end date of the used data set.

3 Existing Literature

Estimating health insurance demand started to become a topic of interest in the United States in the 1980s. Europe followed with this during the 1990s when more and more countries restructured their health insurance markets towards more competition and more insurance provider choice for the insured.[48] This chapter provides an overview of the literature that estimates demand for health insurance plans or providers. The objectives are three-fold. First, to present the body of research that reported health insurance demand elasticities, which can serve as a benchmark for the results in this research. Second, to identify theoretical insights into modeling or estimating health insurance demand. Third, to present the entire body of research of health insurance demand in Germany. In Chapter 3.1, the literature not pertaining to Germany is presented in geographical order and in Chapter 3.2 the German body of literature is presented, ordered by the level of data-aggregation.

3.1 Literature for other Countries

The vast majority of empirical health insurance demand studies outside of Germany were conducted in the United States[49], or in countries where, like Germany, insurance provider choice became available recently (e.g. The Netherlands and Switzerland). Results

[48] The Netherlands undertook such reforms in 1992 and Switzerland and Germany followed in 1996.
[49] Some of the likely candidates for empirical economic research (e.g. Canada or the U.K.) have nationalized insurance systems.

from other countries must be treated carefully when comparing with results from Germany, because the institutional framework that they are conducted in potentially varies greatly from that of Germany. Therefore the applied models could be inappropriate and the results perhaps only moderately helpful as benchmarks when compared to the results obtained in this research. This subchapter also gives a brief outline of the insurance system and major reforms for those countries that had similar reforms to Germany during the 1990s.

3.1.1 The United States

The U.S. insurance market varies greatly from the German market in many respects: Health insurance in the United States is provided through the employer for roughly 90% of all insured population outside of government programs.[50] The average American employee has fewer health insurance providers to choose from but has more choices among different coverage packages and cost-sharing schemes. In the U.S., in the absence of fixed insurance cost sharing rules, an increasing number of employers pay a fixed amount towards the premium and the insured pays the marginal cost of choosing more generous and higher premium plan. Unlike in Germany, in the chosen plan often defines the provider panel in the U.S., which is the set of physicians that one can chose from. Americans also reenroll annually with the plan of their choice while Germans need to actively cancel their membership and enroll in another fund, whereas else they remain in their old fund by default.[51]

[50] Abramson, Buchmueller and Currim (1998)
[51] This list of differences between the German and American health insurance system is by no means comprehensive, but it includes the major differences that are relevant in this research.

The interest in insurance demand in the United States increased greatly in the 1980s when employees increasingly had a choice between several insurance providers, data became more easily available and the increased power of computers enabled the researchers to carry out the empirical analysis. Unlike this (and most German or Dutch) research, most U.S. research is based on individual level data. Exceptions to this are Welch (1986) and Dowd and Feldman (1994). This overview generally abstains from discussing any author's findings with respect to individual characteristics like income, health status, seniority, etc. because the unit of observation in this research is the insurance provider level. All premium elasticities presented here are from the perspective of the insured[52] unless otherwise mentioned. The key findings of the American literature are also summarized in Table 4.

Early research at the individual level faced the problem of potential premium homogeneity across individuals, which would have made it impossible to estimate the parameters on premium in cross-sectional analysis. McGuire (1981) uses a sample of about 900 Yale University employees in 1974 who had the choice between a PGP (Prepaid Group Practice) plan[53] and a Blue Cross plan. While the employee's premium for the PGP was identical for all employees, the premium for the Blue Cross plan depended on the employment status. This premium heterogeneity allowed for an estimation of a two-stage model. In the first stage, McGuire estimated the decision to enroll in any plan, and in the second stage they estimated the decision between the two insurance options. He estimates both a linear and logit specification and concludes that the linear one provides the better fit, even when tested against a control sample.[54] He finds that a one dollar increase in the premium for the Blue

[52] The "perspective of the insured" means that the price in the price elasticity of demand equation is the price the insured pays and the change in price is the insured's marginal premium change.
[53] The PGP had characteristics similar to that of an HMO.
[54] Even though they acknowledge that the logit specification would be the more appropriate one.

Cross plan leads to an increase in the likelihood of enrolling in the PGP by about 4 percentage points. The corresponding cross price elasticity of demand is 0.55.[55]

Holmer (1984) first estimates the family income and the corresponding marginal tax rate to avoid the problem of missing premium heterogeneity in the data. He argues that the alternative use of money is consumption, which, unlike insurance coverage, is purchased with after tax income. The author uses a 1982 sample of several thousand employees of the Department of Health and Human Services with over 20 choices of insurers[56]. Estimating insurance choice with a multinomial logit model yields price elasticities of -0.06 to -0.39, depending on the income level.[57] The average elasticity is -0.16. Furthermore, he reports the supplementary price elasticity for demand for which he considers only the choice between the three fee-for-service options to be -0.51.

Welch (1986) is the first to use a panel data set. He analyzes the Bureau of Labor Statistics (BLS) annual survey of employee benefits plans, which were frozen from 1981 to 1982. Unlike the individual data used in most other U.S. research presented here, Welch's unit of observation is the occupational group within a firm. He estimates a logistic transformation of generalized least squares. To allow for adjustment over time, Welch estimates a partial adjustment model. His dependent variable is the log-ratio of HMO enrollment. He reports the price elasticity of demand to be -0.20 in the short and -0.62 in the long run. The cross price elasticities are 0.16 and 0.49. According to Welch about one third of the adjustment to new prices happens within a year.

[55] Own computation at average potential HMO premium and reported market share for the PGP.
[56] Holmer condenses the choice set to four types of plans - low, medium and high premium fee-for-service plans and HMOs – since most plans within each of the four categories are very similar to each other.
[57] Higher income results in less elastic demand.

Short and Taylor (1989) use individual 1977 data from the National Medical Care Expenditure Survey. By contacting each individual's employer or union, they obtain a data set that contains every individual's complete insurance choice set as well as detailed benefit information on every potentially chosen plan. Short and Taylor propose a sequential model of health plan choice with four steps. The first step is the decision to insure, the second whether to insure the family or individually, the third whether to insure through a traditional plan or through an HMO and the last step is the choice of plan within the chosen type. They find a price elasticity of -0.14 for the choice between traditional plans using binomial logit estimation by always comparing a plan to the next more expensive one. They find a price elasticity of -0.13 between types of plans.[58]

Feldman et al.[59] also estimate a nested logit model using a data set of 17 Minneapolis firms with 3000 individual observations. They define the nests by the level of freedom of provider choice, thus including independent practice associations (IPAs) and fee for service (FFS) plans in one nest and HMOs in the other. Unfortunately they do not report elasticity estimates, but assuming two nests with two plans each (thus on average 25% market share for each plan) and average out-of-pocket premiums result in a price elasticity of -0.60. Alternatively they estimate the model without nests. For three to five plans the resulting elasticity is approximately -0.30.

Ellis (1989) develops a new specification of health plan choice using a nonparametric functional form for the loss function. Using data for insurance choice and out-of pocket expenditures for the employees of one firm that switched from offering one to offering three

[58] They only report that a $100 price advantage of an HMO increases the likelihood of being chosen by 2% to 3%. The elasticity is self-computation using the reported parameter estimate and variable means.
[59] Feldman, Finch, Dowd and Cassou (1989)

traditional plans during 1982 and 1983[60], Ellis finds that the insured put more weight on uncertain expected out-of-pocket expenditures than on certain premium payments and that the insured under estimate low probability/high cost outcomes relative to high probability/low cost ones. Additionally, he finds evidence of status quo bias. Despite the employers attempt to encourage all employees to actively choose a plan, 14.4% of the employed do not do so and default to the lowest deductible plan. Out-of-pocket expenditures in the previous year were not a significant predictor for default behavior. Ellis does not report a demand elasticity estimate, but at the average market share and premium, his estimates result in price elasticities of –1.36 to –1.44.

Barringer and Mitchell (1994) use a one company, four branches and one-year (1989) data set of employee health choice among four plans. Their data include premium heterogeneity since the premiums for the same plan differ across branches. They estimate a multinomial logit model in various specifications, including plan, individual, branch and regional variables. This results in price elasticities between –0.10 and –0.20.[61]

Dowd and Feldman (1994) use an aggregated version of the same data set as in their previous study[62] to estimate a logistic full fixed-effects model, with dummy variables representing the year, the firm, the health plan and the type of coverage. They report only the total premium elasticity of –7.9. Using their reported average out of pocket premium results in a price elasticity of –1.00 from the perspective of the insured.

Marquis' and Long's (1995) study differs from the others because they look into the demand for health insurance of workers who have no employment-based coverage. They merge 1987 and 1988 data from the CPS (Current Population Survey) and the SIPP (Survey

[60] These plans differed only with respect to their financial terms.
[61] Royalty and Solomon (1999) report -0.01 to -0.02 for this study referring to communication with the authors.
[62] Feldman, Finch, Dowd and Cassou (1989)

of Income and Program Participation) with standard insurance product premium data for different geographic markets to estimate a probit model of health insurance coverage. They find a price elasticity of health insurance coverage of –0.27 to –0.40, depending on the income level and the data sample they use. Furthermore they report an income elasticity of demand of 0.15 for either sample.

Buchmueller and Feldstein (1997) use an individual level data set of employees of the University of California, which drastically changed (and increased) the employer's premium contribution in 1994, thus creating a large degree of intertemporal premium heterogeneity. They find that 5% to 6% of those employees facing a premium increase switch plans, while 30% to 50% of those facing a premium increase switch plans. They estimate a probit model with "switching plans" as the dependent variable. They include three premium variables in their estimation: a dummy for any premium increase, the total premium increase and the total premium increase squared. They don't report an elasticity estimate, probably due to the threefold inclusion of premium in the estimation and resulting difficulty for computing the elasticity. They find that even small premium increases cause a large increase in the likelihood of switching. While the likelihood of switching with an unchanged premium is 5.2%, a moderate increase of the premium by $10 increases the chance of switching to 26.4%. They note that a major reason for the observed premium sensitivity is probably that the benefit structure of the University of California health plans is very homogenous, thus eliminating one factor of competition. Compared to plans with identical provider panels, they find the price sensitivity even higher than reported for the overall data set.

Abramson, Buchmueller and Currim (1998) compare different models common in either (health) economic or marketing research. Their focus is on the different treatment of

consumer heterogeneity of plan provider quality assessment. Using parts of the aforementioned University of California data set, they estimate several models.[63] For the estimation with the data for which the insurance choice of the prior year is unknown, they find the model with random coefficients of plans to be the best fit. If the plan choice of the previous year is known, the model with interaction of consumer characteristics and plan and premium variables offers the best fit. They estimate the own- and cross price elasticity of demand separately for households that did and that did not switch plans between 1993 and 1994. For non-switchers (switchers) the own price elasticity is –0.46 (–0.63) and the cross price elasticity is 0.06 (0.59).

Chernew and Scanlon's paper (1998) is one of the first of a newer branch of research that looks into the impact of quality report cards on insurance choice. They use 1995 data from a major U.S. firm with branches in 44 different markets that implemented report cards. They estimate four different specifications of their model: weighted and unweighted share regressions at the branch level and conditional and nested logit with individual level data. For either share regression (but not for the logistic specifications) the authors fail to reject the hypothesis that the premium has no impact on plan choice. They do not report the premium elasticity of demand explicitly, but at the average values for market share and employee's out-of-pocket premium it is -1.91 for the nested logit (within each nest). This elasticity is considerably more elastic than the one found in previous studies, possibly because of the report cards and the company's requirement for all managed care plans to offer a standard coverage package.

[63] They estimate a conventional logit model, two random coefficient models, three models where consumer characteristics are interacted with premium and/or plans and two latent class models.

Cutler and Reber (1998) develop a model to compare benefits of increased competition among health insurance providers with the costs of adverse selection. They utilize an individual level data set from Harvard University. Harvard moved from plan specific partial employer contributions to fixed employer contributions with zero marginal cost sharing in the middle of the 1990s. The fact that the reform applied to the unionized employees a year later than for the non-unionized employees created a natural experiment that the authors exploit in their research. They estimate a latent demand model for PPO demand. They find the out-of-pocket premium elasticity of demand to be -0.30 and -0.60 for the first and second year of the reform respectively. They estimate different forms of their model, including a linear probability model, to test the sensitivity of their results and find the price coefficient significant throughout all specifications and the resulting elasticities to be between -0.20 and -0.40.

Royalty and Solomon (1999) estimate the premium sensitivity in a managed competition setting where benefits are standardized and employees pay the premium at the margin. They use data from all Stanford University employees which they supplement with a survey of a random sample of the employed to get additional information on health plan choices through the employee's spouse, health status and other. They estimate a standard conditional multinomial logit model with four possible plan choices. Unlike other papers, they report own price elaticities for the different plan choices as well as for different specifications and data samples. They report elasticities that range between -0.20 and -0.76. They also test whether using a nested logit model would be the more appropriate approach, but fail to find reason to reject the unnested multinomial logit model. In the last step they estimate a fixed effects logit model. The resulting price elasticities are -0.97 to -1.75,

depending on the plan. The authors acknowledge that the estimated effects could be year effects capturing unmeasured yearly changes other than the premium, but report that there were neither major changes in coverage nor market shocks during the period in question.

Beaulieu (2002) finds a small but significant effect of plan quality information on health plan choice using a conditional logit model with Harvard University data from 1994 to 1997. She finds uncharacteristically large premium effects that result in a premium elasticity of –1.95 to –4.76, depending on age and family status. She does not offer an explanation for this finding, but notes that the results are not robust across specifications.

Strombom, Buchmueller and Feldstein (2002) focus on individual price sensitivity towards health plan premiums and switching costs across individual characteristics. They find that those presumed to have the lowest switching costs (the healthy young with little job tenure) are four times as price sensitive as those with the highest switching costs. Their work builds on the research of Royalty and Solomon (1999), but their University of California system data set is larger, includes an objective health status measure (hospitalization and cancer diagnosis), and due to more years of observation and more locations also includes more price variation. Comparing enrollment numbers for recent versus tenured employees they find those plans with premium increases in the past year to enroll a greater than proportional share of tenured employees, thus indicating the prevalence of switching costs. Unfortunately they only report the resulting demand elasticities for the insurer perspective premium (on average -2.5) and do not report the average out-of-pocket premium, thus making it impossible to compute the resulting out-of-pocket demand elasticity with the published information. When they focus on plans that are close substitutes (by excluding the

only indemnity plan), the insurer perspective demand elasticity becomes more elastic (on average –5.3)

Wedig and Tai-Seale (2002) find evidence that report cards increase price sensitivity using a 1995 and 1996 data set of federal employees. The Office of Personnel Management distributed report cards to only to some of the employees during the 1995 open enrollment period and to all employees in 1996. They estimate a multinomial logit model after finding insufficient evidence that would support a nested logit approach. For the 1995 sample they find a negative impact of report card quality, which the authors explain with potential negative correlation of report plan quality and more visible plan attributes like marketing effort. For 1995 they find a small but significant negative premium effect. The estimated premium elasticity is –0.02 for existing and –0.14 for new employees. For 1996, when report cards were widely they cards had the presumed positive enrollment effect. The premium sensitivity increased significantly and the resulting premium elasticity of demand range is –0.13 for existing employees and –1.04 for new hires.

Goldman, Leibowitz and Robalino (2004) look into the employee's health insurance choice when they face increasing health plan premiums. The authors have data for some 12000 employees of a big U.S. firm for three years (1989 to 1991) during which health plan premiums rose faster than the general price level. The company offered three FFS plans and 43 different HMO plans. The authors estimate a multinomial logit model, which, unlike the other research presented here, explicitly included the option to drop health insurance coverage. Unfortunately they report neither explicit demand elasticities, or the mean market share nor the average out-of-pocket premium. The authors simulate the effects of relative premium increases and find that employees are in fact responsive to price. For single

employees, the likelihood of dropping coverage increases from 7.6% (no relative premium increase) to 12.6%, 20% and 29.6% for relative premium increases of 10%, 20% and 30%. The likelihood to switch increases from 13% to 14.9%, 16.3% and 17% respectively. Employees purchasing family coverage have smaller but still positive marginal propensities to drop coverage, but a higher marginal propensity to switch plans.

Overall, the U.S. literature finds mostly inelastic insurance demand patterns. The closer the choice set resembles the structure proposed by Enthoven's managed competition model[64], the more standardized the coverage packages are and the better informed the consumers are, the more price sensitive the consumer are found to be. Most researchers employed McFadden style multinomial logit models[65], either in the nested or unnested version, depending on the exact structure of the individual choice process. Several papers allowed for and subsequently found inertia in health insurance choice.

3.1.2 The Netherlands

3.1.2.1 The Dutch Health Insurance System

The Netherlands underwent a major reform in 1992 to create a more competitive environment in their mandatory health insurance market. The Dutch system closely resembles the German one, partly due to the German occupying forces imposing the German structure in the Netherlands during the Second World War and the Dutch keeping the system for the most part after the war ended.[66] In the late 1980s the old system was seen as

[64] Enthoven (1988)
[65] McFadden (1978)
[66] See Greß et al. (2001) for a historical overview of the Dutch health insurance system.

Table 4: Overview of the U.S. Literature

Author	Abramson, Buchmueller and Currim	Barringer and Mitchell	Beaulieu	Buchmueller and Feldstein	Chernew and Scanlon	Cutler and Reber	Dowd and Feldman	Ellis	Feldman, Finch, Dowd and Casssou
Year	1998	1994	2002	1997	1998	1998	1994	1989	1989
Data	Employees of four University of California Bay Area campuses in 1993 and 1994	Individual employee data of one firm with 4 branches for 1989	11500 Harvard University employees from 1994 to 1997	11 University of California branches with 75,000 insured between 1993 and 1994	Sample of 5795 non-union employees of one large U.S. firm	9000 Harvard University employees in 1994 to 1996	Employees from five Twin Cities firms for three to four years between 1988 and 1993	About 5000 employees of one firm from 1982 to 1983 that selected single coverage	5161 employees of 17 Twin City firms in 1984
Observation unit	Individual	Individual	Individual	Individual	Individual	Individual	Health plan level	Individual	Individual
Method	Logit, random coefficient on plan or on premium), latent class models	Multinomial logit	Multinomial logit	Probit (switch vs. non-switch)	Multinomial logit	Linear probability for PPO (Preferred Provider Organization) enrollment	Full fixed effects logit model with dummies for firm, year, plan and type of coverage	Generalized logit	Nested multinomial logit
Elasticity	The own price elasticity is -0.46 for the general population and -0.63 for switchers.	-0.1 to -0.2 (Royalty and Solomon (1999) report -0.01 to -0.02 for this study referring to communication with the authors)	-1.95 to -4.76	Not reported	-1.91 (own computation) in logistic non-nested specification at average market share and price.	-0.2	-7.9 from the insurers perspective. -1.00 from insured perspective at mean out-of-pocket premium and market share (own computation)	Not reported. Own computation with average market share and out-of-pocket premium results in elasticities of -1.36 to -1.44	-0.596 (own computation assuming two plans and two nests at 25% market share and average out-of-pocket premium. ~-0.30 for point estimate using non-nested logit specification and 20 to 33% market share.
Choice Set	7 health plans (5 included in analysis)	4 health plan choices	6 to 8 out of 10 health plans	several health plan choices	3.57 health plan choices on average with a minimum of 2 and a maximum of 7.	Eleven plans	3 to 5 health plan choices	3 health plans in 1983 (several HMO choices neglected)	At least one HMO and one "traditional" plan. Exact numbers not reported.
Other Key Results	Switchers are more price sensitive than non-switchers. Cross price elasticity is 0.06 for non-switcher and .59 for switchers.		Younger individuals and single policyholders are more price sensitive than older individuals and family policy holders. Reported quality ratings have the expected impact on plan choice.	$10 out-of-pocket premium increase increases switching probability from 5.2% ($0 increase) to 26.4% ($10) to 29.6% ($20) to 32.9% ($30)	Impact of report cards on insurance choice is less than expected	Adverse selection is a serious concern, but increased competition leads also to significantly lower premiums.		Insured attach significantly more weight to uncertain out-of-pocket expenses than to premiums and underweight high loss/low probability outcomes.	Significant own price sensitivity

Table 4: Overview of the U.S. Literature (continued)

Author	Goldman, Leibowitz and Robalino	Holmer	Marquis and Long	McGuire	Royalty and Solomon	Short and Taylor	Strombom, Buchmueller and Feldstein	Wedig and Tai-Seale	Welch
Year	2004	1984	1995	1981	1999	1989	2002	2002	1986
Data	Individual employee data for one firm (14000 observations) from 1989 to 1991	5287 individual sample of Department of Health and Human Services in 1982	CPS, SIPP and insurers price lists	900 Yale employees in 1974	Stanford University employees 1993 to 1995	About 500 employees surveyed in the 1977 National Medical Care Expenditure Survey	11 University of California branches with over 100,000 distinct employees between 1993 and 1997	Sample of federal employees	BLS annual survey of employee benefit plans from 1981 to 1982.
Observation unit	Individual	Individual	Individual	Individual	Individual	Individual	Individual	Individual	Occupational group at firm establishment level
Method	Multinomial logit	Estimate household income and marginal tax rate with OLS using CPS data and multinomial logit for plan category choice	Probit	Two-stage Linear and logistic model - first stage decision to insure, second stage which insurer	Multinomial logit (with and without fixed effects)	Multinomial logit	Multinomial logit	Nested multinomial logit	Logit with partial adjustment
Elasticity	Not reported	-0.16 for price elaticity and +0.01 for income elasticity of demand	-0.27 to -0.4	0.55 (own computation) cross-rice elasticity for enrollment in the prepaid group insurance with respect to the HMO price at average hypothetical HMO out-of pocket premium and YHE market share.	Without FE: -0.204 to -0.760 with FE: -0.966 to -1.753	Between traditional plans: -0.14 (reported) and -0.129 (own computation) between HMO and traditional plan: not reported	Insurers Perspective. All Plans: -2.5 (average), -0.8 to -5.2 (range). Only HMOs: -5.3 and -2.3 to -6.6	-0.02 to -0.13 1995 (without report cards) and -0.13 to -1.04 in 1996 (with report cards)	-0.2 (short run) -0.62 (long run)
Choice Set	Three FFS and several HMOs	23 plans aggregated into 4 plan categories	Insurance vs. no insurance	Two health plans or no coverage	3 plans in 1993 and 4 in 1994-1995	Either one HMO and one traditional plan or two or more traditional plans	4 to 7 health plan choices	maximum of five HMOs	One PGP (HMO) and one conventional insurance
Other Key Results	10% out of pocket increases likelihood to un-enroll from plan (drop coverage or switch insurer) from 20.7% (0% increase) to 27.7% (10%) to 36.5% (20%) to 46.8% (30%)	"Supplementary" price elasticity between the three fee-for-service nests is -0.51	Greater price sensitivity for poorer families		Younger and healthier insured are more price sensitive.	Price sensitivity between traditional plans twice as high as between HMOs and traditional plans.	Younger employees and newly hired are more price sensitive. No clear connection between risk group and price sensitivity.	Report cards greatly increase consumer price sensitivity.	1/3 of adjustment occurs in any year

inefficient, which led to the reforms of 1992. The Dutch reforms have been based on Enthoven's (1988, 1993) model of managed competition.[67]

Starting in 1992, all sickness fund members became able to choose their fund freely. As in Germany, everyone below a certain income threshold is mandatorily insured through a sickness fund. Unlike in Germany, those with an income above the threshold cannot maintain voluntary membership in the sickness fund system and have to insure privately.[68] The premium structure has two parts. One part is a fixed percentage of the insured's income, which is legally mandated and equal for all funds. The employer and the insured employee each pay half of this income-related premium. In addition each fund charges a flat-rate per capita premium, which varies across funds[69] and encourages funds to compete on price. The funds receive about 10% to 15% of their revenue from the per capita premium.[70] Until 1995, the flat-rate premium was almost uniform across funds[71], but starting in 1996 the variation increased. Having no former experience with optimal premium setting under competitive conditions, the funds faced considerable uncertainty with respect to the optimal price. This could be the reason for the ever-increasing premium spread and standard deviation of the premiums.[72] The coverage package is highly standardized so that price and service are in essence the only parameters on which funds can compete.

There are relatively few sickness funds operating in the Netherlands. In 1992, 27 previously regional funds started competing nationwide and since barriers to entry were

[67] For an in-depth comparison of the Dutch system and the managed competition model see Greß, Okma and Hessel (2001).
[68] Therefore "only" 62% of the population is covered through sickness funds in the Netherlands compared to about 90% in Germany. Nevertheless all but about 0.1% of the Dutch population has health insurance.
[69] This feature is new since 1992. Before 1992 all contributions to the funds were made through payroll deduction.
[70] Schut, Greß and Wasem (2003)
[71] Greß et al. (2002) report that only one fund charged a flat-rate premium that differed from the others: 192 NGL for the one fund vs. 198 NGL for all others.
[72] Schut and Hassink (2002)

removed during the reform, nine more funds entered the market between 1992 and 2000.[73] Compulsory sickness funds can also offer supplementary insurance coverage, which about 97% of the sickness fund members purchase. Since one can only purchase supplementary insurance coverage from the same fund that is one's provider of compulsory coverage, the premium for supplementary insurance coverage is a further parameter for competition. Often the compulsory funds align themselves with private insurers operating under the same brand name.

One of the key features of the 1992 reforms is the transition from retrospective to risk-adjusted payments to the funds. The fund's financial risk has steadily increased over the years.[74] Unlike in Germany, since 1992 funds have been able to engage in selective contracting and managed care schemes, but few have done so during the 1990s.

3.1.2.2 Dutch Literature

Greß et al.[75] correlate membership gains and losses between 1995 and 1999 with flat rate premium levels. They find only a small negative correlation of –0.21 between these two variables. One reason might be that the premium spread is still relatively narrow. The difference between the most and least expensive fund is only about 90 NLG per year, while all but two funds fall within a range of about 40 NLG. The authors also obtain data from the Dutch Health Care Consumer Panel, which asked about 1100 mandatorily insured individuals about their perception of fund heterogeneity. For none of the eleven premium, service or benefit related categories that were asked in the survey, does the share of respondents who

[73] Schut and Hassink (2002)
[74] Schut and Hassink (2002) provide a good overview over the gradual expansion of the risk sharing and adjusting scheme.
[75] Greß et al. (2001) and Greß et al. (2002). The German part of that paper is discussed in length in Chapter 3.2.

think that there are large or very large differences between funds exceed 30%. This lack of perception of large premium differences might explain the low responsiveness to premium levels.

Schut and Hassink (2002) are the first to report demand elasticities for the Netherlands. They use 1995 to 1999 fund level enrollment and premium data for supplementary and compulsory insurance coverage. They regress the log market shares of the funds on the premiums for compulsory and supplementary coverage (and combined premium levels in another specification), fund specific dummies and a dummy for new entries. They estimate the elasticity of demand to be -0.28 with respect to the premium for compulsory coverage and -0.84 with respect to the premium for supplementary coverage. If the two premiums are aggregated the joint elasticity is -0.40.

The authors argue that for price competition to be effective, the premium level of a fund has to be explainable by factors beyond the fund's control, in their case the initial financial reserves and the uncompensated medical expenditures. They find a significant level of unobserved premium heterogeneity across funds, which leads to the conclusion that funds have considerable latitude in setting premiums.

Schut, Greß and Wasem conduct a study of consumer price sensitivity comparing the Netherlands and Germany.[76] For the Netherlands, they are able to obtain a complete fund level data set for the years 1996 to 2000 containing all 25 funds that existed in 1996.[77] They obtain enrollment and out-of-pocket premiums for mandatory as well as supplementary coverage. They derive a utility maximization model following McFadden (1974) and estimate a fixed effects linear transformation of the model following Scanlon et al. (2002).

[76] Schut, Greß and Wasem (2003). The German part and a critique of this paper is in length in Chapter 3.2.2.
[77] They exclude four funds that entered the market after 1996.

They find only low, though with one exception, non-significant price effects. The resulting elasticities range from –0.14 to –0.41 for the entire population for the premiums of compulsory premiums and 0.02 to –0.37 for supplementary premiums. By tendency, the elasticity seems to decline over time. Breaking down the enrollment numbers into pensioners and non-pensioners they find pensioners to be slightly less price sensitive.

3.1.3 Switzerland

3.1.3.1 The Swiss Health Insurance System

Switzerland underwent a statutory health insurance reform similar to the one in Germany.[78] Since 1996 the insured have a choice among all compulsory insurance providers.[79] The Swiss have two open enrollment periods per year[80] and every resident of Switzerland in forced to enroll for compulsory insurance. The insurers are forced to accept any applicant regardless of health risk. The insurers are non-profit organizations of various juridical or institutional forms. They operate either locally, on the canton (or across several canton) level or nationwide.

The insurers set a flat community rated premium for children, young adults and older adults. Unlike in the German system, in Switzerland every family member has to be insured individually. Each insurer offers five plans that differ only with respect to the deductible. The limits are equal for all insurers (230 Sfr, 400 Sfr, 600 Sfr, 1200 Sfr and 1500 Sfr) and thereafter everyone has a co-payment of 10% for any health care costs of up to 6000 Sfr

[78] For a comprehensive overview see European Observatory (2000-2), Colombo (2001) and Gerlinger (2003). A good description of the historic origins is provided by Theurl (1999)
[79] There were 109 insurance providers in 1999, down from 148 in 1996. About 60 to 70% of the funds are very small, insuring under 10000 persons. Colombo (2001)
[80] June 30th and December 31st.

beyond the deductible.[81] Furthermore some insurance companies offer "bonus insurance" contracts, which lead to reduced future premiums if the insured does not incur health care costs. Other insurance providers offer those insured that agree to participate in a managed care program with a limited provider panel, a further premium reduction of up to 20%.[82] Even though the premium is set independent of income, the law mandates that no one should spend more than 10% of his income on health insurance. The cantons regulate the process of subsidizing the health insurance costs for low-income receivers.

In addition to the mandatory compulsory insurance coverage, which is mandated to offer a standardized coverage package, the Swiss have the option to purchase supplementary insurance coverage for better hospital accommodation, treatment by the head physician and other treatments not covered under the standard compulsory benefit plan. About half of the compulsory insurance providers, as well as other private insurance providers, offer supplementary coverage, and any insured is free to pick any supplementary insurance provider. The premiums for the supplementary insurance coverage are risk based. Furthermore, a voluntary daily cash benefit insurance scheme exists that replaces income lost to sickness. Employers often purchase supplementary insurance as a fringe benefit in the form of group insurance for their employees.

3.1.3.2 Swiss Literature

Colombo (2001) focuses her research on characterizing insurance switchers. Using individual survey data, she finds that 84.4% of those surveyed never switched their insurer

[81] Choosing the 1500 Sfr deductible causes a premium reduction of up to 40% over the base premium with 230 Sfr deductible. About 55% of the insured choose ordinary plan with the lowest possible deductible. Colombo (2001)

[82] Only 8.62% of the insured choose the limited provider model and only 0.16% the bonus insurance plan model. Colombo (2001)

and, of those, 88.2% do not have the intention to ever switch. During the first two years of the new system about 5% of the sampled population switched in either year, and in 1999 and 2000 the share of switchers shrank to 2.7% and 2.1%. The healthier are more likely to switch than those with a poor health status, and those in the age range from 26 to 40 are most likely to switch. She identifies several categories of non-switchers. "Passive non-switchers" are those who would never consider switching unless some major performance or price shock occurs, because of their aversion to change, insensitivity to insurer performance or because they a priori consider the costs of switching as too high when compared to the benefits of switching. She estimates this group to consist of about 30% of the non-switchers. A second category consists of the "informed or non-informed non-switchers". Colombo estimates that more than half of the non-switchers belong to this category. The "informed non-switchers" are those who compare costs and benefits, but find it beneficial to remain with the current provider. The "uninformed non-switchers" do not find worthwhile to compare funds because they are either happy with their current fund or find the search cost too high. The last and smallest category are the those who think that they cannot switch because they are either unaware of the changes in the system, have experienced illegal cream skimming or wrongfully think that pre-existing conditions prevent them from being eligible to switch.

Switching amongst different plans within one's fund is actually much more prevalent than switching between funds. More people make an insurance choice by changing the deductible or moving in or and of a managed care plan or the "bonus insurance" contract while staying with their insurer than switch insurers.

Switching seems to be predominantly motivated by premiums. About 26% cite rising premiums as the main reason to switch, while 17% cite better premiums elsewhere. Further,

7% cite an insufficient premium/benefit ratio (which is somewhat surprising given that the benefits are standardized and only service can be heterogeneous). About 25% give a reason other than price and another 25% give no reason or "other reasons". These data suggest that approximately two thirds of those responding with a reason for switching mention the premium as the trigger for switching.

One of the goals of increased consumer choice is efficiency gain. Colombo states that having huge numbers of switchers is not necessary for the achievement of efficiency gains. Even small numbers of switchers can discipline providers by signaling that the market is contestable. On the other hand, too much switching can be inefficient because the process of switching itself causes administrative costs.

There has been no research in Switzerland to date that measures the price responsiveness of the insured. Therefore no benchmark estimates are available for comparison with this research.

3.2 Germany

The German research on health insurance focuses on two major questions. How did the consumers react to the choice of fund that the 1996 reform offers to them and whether the risk structure adjustment (RSA) is working as intended? The research that seeks to answer the first question is presented here, which includes the literature that looks into switching patterns and motives.[83]

[83] Understanding the motives will help interpreting the results of this research.

3.2.1 German Literature using Aggregated Data

Müller and Schneider (1997, 1998, 1999) published a series of annual papers that describes the state of the health insurance market and the impact of the right to choose one's fund on enrollment. In Müller and Schneider (1997), the authors provide a first insight into the effects Health Reform Act using the KM1 statistic provided by the Ministry of Health, which contains enrollment and contribution rate information aggregated by type of fund and state. They find that the AOKs in states where their contribution rate exceeds the average contribution rate the most lost the largest share of their members. They further find a similar effect for the BKKs and the IKKs at the state aggregation level, particularly in the western states. The substitute funds, which mostly operate at the national level, also show a clear negative correlation between contribution rate and enrollment change.

In their second paper, Müller and Schneider (1998) confirm the trends they found in their previous work despite not undertaking any kind of statistical estimation but merely tabulating membership changes and average contribution rates at the state level. The type of funds that charged a particularly low (high) contribution rate saw their membership increase (decrease) more than the average.

They also look into the relative importance of the right to switch funds during the two month following a contribution rate increase. They find no clear evidence that this additional switching window triggers sizable membership movements, particularly in relation to the switching during the regular end-of-year open enrollment period. In their third paper, Müller and Schneider (1999) confirm the trend that they observed in their previous papers.

Greß et al. (2002) compare the results of competition in the Netherlands and Germany since both countries adopted competitive features for their social health insurance systems at

approximately the same time.[84] For Germany, they correlate the absolute member gains/losses against the average contribution rate by type of fund for the period from 1995 to 2001. They find a high correlation of -.99 for the old states and -.82 for the new states. They have data for the individual AOKs and find a correlation of -.87 in the old states. Using the German Socio-Economic Panel's questions about switching motivation, they report that 59% of those who switched cited lower contribution rates as their main incentive for switching. This number was even higher for those leaving the (on average more expensive) AOKs and EKs and much lower for those leaving one of the BKKs that on average have lower contribution rates.

3.2.2 German Literature using Fund Level Data

Two papers used German sickness fund level data for analyzing demand for sickness fund coverage. Böcking et al. (2002) use fund level data from 1996 to 1998 and manage to disaggregate it into 39 groups of similar funds without specifying how they do it. Using ordinary least squares, they regress the absolute change in enrollment against the level and change of the contribution rate and various other fund characteristics including claims, personnel costs and distribution network expenses per insured as well as the share of non mandatory insured and the market share.

This approach has several problems. First, estimating the absolute change may be inappropriate for a market where the fund size varies from a few thousand to several million members. This problem will be addressed in more depth in this research. Second, they use the market share of a fund as an explanatory variable, which is certainly correlated with the

[84] See Chapter 3.1.2.2 for a discussion of the part of the paper investigating the Netherlands.

error term since a positive error term causes a higher market share directly.[85] Third, they posit that the change in the contribution rate has no impact on the change in enrollment. They come to that conclusion by normalizing the estimated coefficients. The estimated (not normalized) coefficient is 0.286 (t-value 4.872, it remains unclear what 0.286 means (probably change in thousand members per percentage point change of the contribution rate) and the average change is 0.16 percentage points. Thus normalizing the parameter to a change of 1 (=100 %) gives a normalized factor of 0.000 (probably rounded), which is not intuitively appealing since a change of the estimated parameter by 1 % of its average value would be a change by 1/6000 percentage points. Thus the price change is a significant explanatory variable, but one with an unexpected positive sign that the authors fail to discuss further.

Thus the main conclusion of their paper, that the level of the contribution rate has a significant negative impact on enrollment while a change in the contribution rate itself has no effect, is not supported by their own results. They offer two explanations for the relative importance of the premium level. First, people might respond to premium changes with a time lag. A reason for the lagged response could be information deficits on the side of the consumer. Second, they observe that premiums tend to move in the same direction across funds, which they argue could soften the impact of price changes on demand.

Schut, Greß and Wasem (2003) look into the price sensitivity of insurer choice in both Germany and The Netherlands.[86] They use a random utility model to estimate the price effect on a fund's market share. For Germany they have data for 44 individual funds, including all the AOKs and EKs, but only for a few guild and company based funds.

[85] Unless the authors used last year's market share. They fail to indicate precisely which one they used.
[86] A discussion of the results for the Netherlands is found in Chapter 3.1.2.2.

Therefore they construct residual funds for both the guild and the company-based funds. From a typical utility maximizing model they derive a log linear equation that they estimate for different time periods and subgroups of the insured.

Converting their parameters of the price effect into elasticities at the average contribution rate, they find the elasticity to be -3.45 and to be significant at the 95% confidence interval. They also estimate the price impact on enrollment by type of fund and find the elasticities between -1.39 and -4.31, depending on the time frame chosen. The demand seems to be more elastic in later years. For the 1997 to 2000 time frame, the only one for which they were able to compute and receive significant results with either method, they find the elasticity to be larger for the individual fund than for the type of fund. This seems intuitive given that the type-of-fund approach does not capture within-type switching.

Their approach however has one major flaw. They estimate the following fixed-effects equation:

$$\ln\left(S_{jt}/S_{ft}\right) \approx \beta'\left(X_{jt} - X_{ft}\right) + \left(\gamma_j - \gamma_f\right) + \sum_{t=1}^{T} T_t \times \tau_t + \upsilon_{jt} \qquad (1)$$

S_{jt} denotes fund *j's* market share in period *t*, X_{jt} the fund's observable and time-variant characteristics (contribution rate), γ_j denotes the fund's time invariant and unobservable characteristics, T_t are time dummies for each year and υ_{jt} is the error term. Subscript *f* denotes an arbitrarily picked fund[87].

The problem with their approach is that it implies the assumption that the different levels of enrollment are explainable solely by people's current preferences and they do not allow for inertia which could be caused by switching or search cost. Testing their

[87] The inclusion of the arbitrary fund is necessary to cancel out the denominator that is found in a typical logit equation.

specification against the data used in this research yields results are neither significant nor do they have the right sign for most years.

3.2.3 German Literature using Individual Person Level Data

While the U.S. literature focuses mostly on individual-level data, there are relatively few publications using this type of data in Germany. This is caused by the limited availability of individual level data. Andersen und Schwarze (1999) analyze the characteristics of those sickness fund members who did switch or thought about switching in 1997 and 1998. They use the GSOEP, which included several questions about switching intention and motives during the early years after the reform. The switchers in 1997 named lower contribution rates as the main reason to switch while better coverage, service or image were only secondary reasons. Those who thought of switching and subsequently did in 1998 however chose more likely better coverage slightly ahead of lower contribution rates. Better service was a distant third while the funds' image became almost completely unimportant as a motive for switching. There are several possible explanations for this pattern. One could be that funds were initially only able to distinguish themselves by their contribution rate and it took a while for the funds to communicate other differences to the consumer. Second, around 1998 funds briefly competed by offering a variety of courses that had only nominally roles in the promotion of basic health activity or prevention[88]. Third, it is possible that most of the consumers' sorting into the optimal fund (with premium being the main determinant) took place in the first year of choice and thereafter other factors didn't gain absolute, but only relative importance compared to the contribution rate. Fourth, the initial importance of the

[88] Some fund even offered snowboard courses, certainly not a health enhancing activity relative to other choices of physical activity, but definitely a good marketing tool to attract young and healthy members.

reputation of the EKs and the sharp drop of it thereafter can be explained with the pre-1996 system, when those who had to insure through the AOK funds perceived the EKs as something better since the EKs could only be chosen by white collar workers. Initially the EK funds gained members despite their relatively high contribution rate, but soon they were perceived like any other fund. The authors also estimate a probit model of switching using several socio-economic explanatory variables. However, comparing the results for 1997 and 1998 offers more confusing and non-significant results than further insights of importance.

In their follow-up work Schwarze and Andersen (2001) are the only ones to date who have utilized the GSOEP (German Socio-Economic Panel) individual level data with the additional information on the exact choice of fund[89]. Matching premium information with the GSOEP data, they find that while switchers paid a slightly higher premium in 1999 than non-switchers[90] (13.78% vs. 13.60%), in 2000 the 1999 switchers paid substantially less than non-switchers (12.61% vs. 13.66%). This indicates that in fact the insured move towards the lower premium funds. They find that on average switchers are younger, more likely employed, have a better health status, lower health care utilization and are more likely single or heads of smaller (three person) families. Income and education have no clear correlation with switching behavior. However their research focuses on the fourth year of possible switching behavior so it is possible that people with higher income and education have already switched in the first three years and sorted themselves into the best fitting fund.

Estimating a binomial probit model of fund switching they find a strong positive impact of the contribution rate on switching. They find that an increase of the contribution

[89] Since 1999 the GSOEP includes a question about the exact name of one's fund. This variable is not available in the public use version of the GSOEP.
[90] Switchers are those who switch between 1999 and 2000, non-switchers are those who remained in their 1999 fund.

rate by 1 percentage point translates into a 4.2% increase in the likelihood to switch funds. Given an average contribution and switching rates of 13.60% and 4.7% this translates into a contribution rate elasticity to switch of 11.8.[91] They also find that membership of a BKK increases the likelihood of switching, likely because the BKKs accepted most of the early switchers before 1999 and therefore have a membership base which is more price sensitive than the one of the other types of funds which have a larger share of those member which have never switched so far.

Lauterbach and Wille (2001) use the GSOEP to estimate the movement between types of funds from 1996 to 1999. Their findings support the image hypothesis of Andersen and Schwarze (1999) that the relative initial importance of image as a motive for switching was caused by the EK's positive image, which lost its importance quickly. The authors report that while BKKs, IKs and EKs all gained members in 1996, the EKs gained them predominantly from the AOKs (a trend that even on a lower level continued in 1997 and 1998), while starting in 1997 a massive outflow of EK members to the BKKs took place. When they look into the socio-economic characteristics of switchers versus non-switchers, they basically confirm the finding by other authors.

Jacobs et al. (2001) merge data from different governmental and fund sources and find that between 1995 and 1999 about 20% of all funds with about 70% of all insured lost members (on average 10%) while the other 80% of the funds gained members. The 30 fastest growing funds with a combined market share of 1.2% in 1999 were all BKKs and the eight fastest growing funds saw an average membership increase of 7200%!

[91] Note that this is not to be compared with the contribution rate elasticity of demand. A 1 % increase of the contribution rate leads to an 11.8 % increase in the likelihood to switch. For example if the premium increases from 13.6 to 14.6% (1 percentage point increase from the mean is equal to a 7.4% increase in the contribution rate), the likelihood to switch increases from 4.7% (average) to 8.8% (87% increase).

Zok (2003) looks into the fund members' perceptions and knowledge of their fund's contribution rate and their willingness to consider switching. Only 13.8% of the interviewed were able to name the exact contribution rate. 61.7% claimed a lower contribution rate than the actual one and only 24.5% overestimated the rate they paid. More than half of those interviewed reported a contribution rate that deviated more than 0.5 percentage points from the one they pay. Zok finds that, with the exception of those who pay the lowest contribution rate, the contribution rate and the likelihood to have thought about switching is positively correlated. Also the better informed (those who where able to name their contribution rate plus/minus 0.5 percentage points) have thought about switching significantly more than those with less knowledge of their contribution rate or who didn't know the contribution rate at all. Overall 23.4% of the interviewed claimed to have thought of switching.

3.3 Literature Review – Summary

The U.S. research provides a range of demand elasticity estimates. Deriving a benchmark for Germany using the U.S. results is difficult given the vast differences between the two systems. Standard economic theory would suggest that the greater diversity of plan characteristics in the U.S. as well as the smaller number of plans to choose from results in less premium elastic demand for health insurance in the United States compared to Germany. The fact that in Germany switching sickness funds requires action by the insured, while in the United States the insured have to sign up with the insurer of their choice set on an annual basis would make one expect health insurance demand to be more elastic in the U.S. Therefore the total effect of the different systems is somewhat ambiguous.

The German literature is still sparse on providing good benchmark estimates for price elasticities. The few papers that attempted an estimation showed major flaws in their design. Therefore the resulting elasticities cannot be used for comparison. Most papers, however, have found that premium levels or changes have an impact on fund choice and in the descriptive research contribution rate levels are constantly mentioned as a major factor influencing insurance choice. Some of the European research found evidence of inertia, due to switching or search costs that have to be taken into account in this research.

4 The Model

This chapter consists of two parts. In the first part a general model for sickness fund membership is developed. In the second part potential endogeneity issues are identified and discussed.

4.1 The Theoretical Model

An individual receives utility from consumption, his health status and leisure.[92] His hours worked and thus his income are assumed to be exogenous. Differences among sickness funds include the contribution rate, certain non-mandated coverage and general features like accessibility. The individual chooses his sickness fund j and consumes the residual net income (C_{ijt}) in order to maximize his expected utility given the distribution of health conditions and the impact of the sickness fund's coverage and service characteristics on his health status and his budget constraint

$$C_{ijt} = (1 - \tau_{it}) \times Y_{it} - p_{jt} \times \min\left(Y_{it}, \overline{Y_t}\right) \qquad (1)$$

The average income tax rate is denoted as τ_{it}, the contribution rate of fund j as p_{jt}, the individual's income as Y_{it}, and the maximum income subject to fund contribution payments as $\overline{Y_t}$.

[92] Leisure time is defined as the initial time endowment minus exogenous work time minus time needed to deal with the sickness fund.

In the context of this research it is beneficial to express the person's utility as an expected indirect utility function of all the exogenous parameters that influence his choice. An individual's expected indirect utility from plan j in period t thus depends on the fund's characteristics (X_{jt}) the switching costs (λ_{jt}), which depend on the individual's fund in the previous period HI_{it-1} and the exogenous variables in the budget constraint. Thus individual's i expected indirect utility from fund j in period t is

$$V_{it}\left(X_{jt}, p_{jt}, Y_{it}, \overline{Y_t}, \tau_{it}, \lambda_{ijt} \middle| HI_{it-1}\right) \tag{2}$$

The individual is limited in his choice to those funds that are open to him.[93] The set of all existing funds in period t is J_t and the set of all eligible funds for the individual is denoted $K_{it} \in J_t$. Thus the optimization problem of individual $i \in I$ is

$$\max_{j \in K_{it}} V_{it}\left(X_{jt}, p_{jt}, Y_{it}, \overline{Y_t}, \tau_{it}, \lambda_{ijt} \middle| HI_{it-1}\right). \tag{3}$$

Let $HI_{it} = j$ if individual i chooses fund j in period t. Then the probability of the individual choosing fund $j \in K_{it}$ in period t is

$$prob\left(V_{it}(X_{jt}, p_{jt}, Y_{it}, \overline{Y_t}, \tau_{it}, \lambda_{jt}) > V_{it}(X_{kt}, p_{kt}, Y_{it}, \overline{Y_t}, \tau_{it}, \lambda_{kt})\right) \quad \forall k \neq j, k \in K_{it} \tag{4}$$

Let I_{jt} be the population for which $j \in K_{it}$. Adding the choice probabilities across all I_j yields the expected membership for fund j in period t

$$M_{jt}^{D} = \sum_{I_{jt}} prob(HI_{it} = j) \tag{5}$$

Many funds compete in several geographic markets and face a different set of competitors in each market. The set of fund j's competitors is

[93] One could argue that not everyone has a full information set and thus the model needs to incorporate some kind of search process. Since any search effort depends on the unknown current information set and also unknown expectations of what to learn from searching, the search effort is not modeled.

$$C_{jt} = \bigcup_{i \in I_{jt}} K_{it} \wedge j \tag{6}$$

Fund *j's* demand can therefore be written as

$$M_{jt}^{D} = D_t^j \left(p_{jt}, p_{Cjt}, X_{jt}^{o}, X_{Cjt}^{o}, M_{jt-1}^{D}, S_{jt}, I_{jt} X_{jt}^{u}, X_{Cjt}^{u}, \varepsilon_{jt}^{uo}, \varepsilon_{jt}^{uu} \right). \tag{7}$$

The non-mandated benefits and services that are observed by the researcher are denoted X_{jt}^{o} and those that are unobserved are denoted X_{jt}^{u}. The vector of all non-price fund attributes is $X_{jt} = \left(X_{jt}^{o}, X_{jt}^{u} \right)$. The vector $X_{Cjt} = \left(X_{Cjt}^{o}, X_{Cjt}^{u} \right)$ for all other funds is defined analogously. The error term $\varepsilon_{jt}^{u} = \left(\varepsilon_{jt}^{uo}, \varepsilon_{jt}^{uu} \right)$ includes factors that are observed by the market participants but not by the researcher $\left(\varepsilon_{jt}^{uo} \right)$ and factors that are unobserved by the researcher and unknown to the fund managers at the time they make their decisions $\left(\varepsilon_{jt}^{uu} \right)$. The vector S_{jt} denotes socio-economic variables that impact demand and are observed by both the fund and the researcher. Whereas all X_{jt} are the choice of the fund (and X_{Cjt} the choice of all other funds), the ε_{jt}^{u} are not.

The cost function *TC* of fund *j* in period *t* is

$$TC_{jt} = c_t^j \left(M_{jt}, X_{jt}^{o}, X_{jt}^{u}, W_{jt}^{o}, W_{jt}^{u}, \gamma_{jt} \right) \tag{8}$$

The cost factors $W_{jt} = \left(W_{jt}^{o}, W_{jt}^{u} \right)$ are exogenous as well as fund and time specific. The researcher as well as the fund managers observe W_{jt}^{o}, while W_{jt}^{u} are observed only by the fund managers. Initially neither observes the error term γ_{jt}.

The fund forms expectations about its competitors' contribution rates p_{Cjt} and all other fund characteristic choice variables X_{Cjt}. For simplicity it is assumed that all funds know each other's fund choice variables X_{Cjt} with certainty and form expectations about the

rates of all other funds with f_{jP} denoting the density function of the distribution of these contribution rates.

Since funds are non-profit firms, their objective is unknown to the researcher. However the likely objectives are either to maximize membership, to provide generous coverage, to charge a low premium or any combination of these. Here it is assumed that the fund maximizes the expected membership and that any knowledge that fund *j* possesses is also knowledge of all its competitors C_j. Thus

$$\max_{P_{it},X^{o}_{it},X^{u}_{it}} E(M_{jt}) = E_{P_{Cjt}\varepsilon^{uu}_{jt}} D^{j}_{t}\left(p_{jt},p_{Cjt},X^{o}_{jt},X^{o}_{Cjt},M_{jt-1},S_{jt},I_{jt},X^{u}_{Cjt},X^{u}_{Cjt},\varepsilon^{uo}_{jt}\varepsilon^{uu}_{jt}\right) \quad (9)$$

subject to the zero-profit constraint

$$\begin{aligned} E(\pi_{jt}) = E_{P_{Cjt}\varepsilon_{jt}\gamma_{jt}} \{ & p_{jt} D^{j}_{t}\left(p_{jt}, p_{Cjt}, X^{o}_{jt}, X^{o}_{Cjt}, M_{jt-1}, S_{jt}, I_{jt}, X^{u}_{jt}, X^{u}_{Cjt}, \varepsilon^{uo}_{jt}, \varepsilon^{uu}_{jt}\right) \\ & - c^{j}_{t}\left(M_{jt}, X^{o}_{jt}, X^{u}_{jt}, W^{o}_{jt}, W^{u}_{jt}, \gamma_{jt}\right)\} \end{aligned} \quad (10)$$

The optimal choice variables depend on the parameters of the model and can be written as

$$p_{jt} = p^{j}_{t}\left(X^{o}_{Cjt}, M_{jt-1}, S_{jt}, I_{jt}, X^{u}_{Cjt}, \varepsilon^{uo}_{jt}, W^{o}_{jt}, W^{u}_{jt}, f_{jP}, f_{j\varepsilon}, f_{j\gamma}\right) \quad (11)$$

$$X^{o}_{jt} = x^{oj}_{t}\left(X^{o}_{Cjt}, M_{jt-1}, S_{jt}, I_{jt}, X^{u}_{Cjt}, \varepsilon^{uo}_{jt}, W^{o}_{jt}, W^{u}_{jt}, f_{jP}, f_{j\varepsilon}, f_{j\gamma}\right) \quad (12)$$

$$X^{u}_{jt} = x^{uj}_{t}\left(X^{o}_{Cjt}, M_{jt-1}, S_{jt}, I_{jt}, X^{u}_{Cjt}, \varepsilon^{uo}_{jt}, W^{o}_{jt}, W^{u}_{jt}, f_{jP}, f_{j\varepsilon}, f_{j\gamma}\right) \quad (13)$$

where $f_{j\varepsilon}$ and f_{jy} denote the density functions of ε^{uu} and γ.

4.2 Endogeneity Issues

Based on the above model, estimation of the demand equation poses several endogeneity (or omitted variable) problems, caused by correlation between

a) the error term and the firm's choice variables in the demand function,

b) the error term and lagged quantity variables in the demand function,

c) the error term and the competitors' choice variables in the demand function.

4.2.1 Correlation between the Error Term and the Firm's Choice Variables

The error term has three components.

- ε_{jt}^{oo}, which is unobserved by the fund as well as the researcher and thus does not lead directly to endogeneity problems. However, if ε_{jt}^{oo} is correlated ε_{jt-1}^{oo}, it is also correlated with lagged demand M_{jt}^{D}.
- ε_{jt}^{uo}, which is observed by the firm and thus impacts its decision making and could thus cause an endogeneity bias.
- X_{jt}^{u}, which causes an omitted variable bias if X_{jt}^{u} is correlated with any of the right hand side variables.

Using instrumental variables can address this problem. The problem is to find instruments that are correlated with the contribution rate or the non-price attributes but not with the error term. Potential instruments are variables that impact the cost or revenue side of a fund but not demand (see the in depth discussion in Chapter 6.8.1).

4.2.2 Correlation between the Error Term and Lagged Demand

Serial correlation of the error terms can cause endogeneity. In the presence of any type of inertia (e.g. switching or search costs), a fund's membership in period *t* depends on the membership in the previous period *t-1*,

$$M_{jt}^{D} = D_t^j\left(p_{jt}, p_{Cjt}, X_{jt}^{o}, X_{Cjt}^{o}, M_{jt-1}, S_{jt}, I_{jt} X_{jt}^{u}, X_{Cjt}^{u}, \varepsilon_{jt}^{uo}, \varepsilon_{jt}^{uu}\right) \tag{7}$$

and thus, since M_{t-1} depends on M_{t-2},

$$M_{jt-1}^{D} = D_{t-1}^j\left(p_{jt-1}, p_{Cjt-1}, X_{jt-1}^{o}, X_{Cjt-1}^{o}, M_{jt-2}, S_{jt-1}, I_{jt-1}, X_{jt-1}^{u}, X_{Cjt-1}^{u}, \varepsilon_{jt-1}^{uo}, \varepsilon_{jt-1}^{uu}\right) \tag{14}$$

Therefore all the unobserved variables that affect any M_{js}^{D} are also determinants of M_{jt}^{D} for $s<t$. Hence, if there is any intertemporal correlation between X_{jt}^{u} and X_{jt-1}^{u}, X_{Cjt}^{u} and X_{Cjt-1}^{u}, ε_{jt}^{uo} and ε_{jt-1}^{uo} or ε_{jt}^{uu} and ε_{jt-1}^{uu}, the parameter on M_{jt-1} would be biased.

Fortunately, the data include the fund membership for January 1st, 1996, the last possible observation before the deregulation took effect. Therefore M_{1996} can be assumed to be exogenous and can be used as an instrument for the M_{jt-1} of all subsequent years.

An alternative solution would be differencing. If the entire error term

$$\upsilon_{jt} = \upsilon\left(\varepsilon_{jt}^{uu}, \varepsilon_{jit}^{ou}, X_{jt}^{u}, X_{Cjt}^{u}\right) = \xi_{jt} + \eta_j \tag{15}$$

consists of a time-variant ξ_{jt} and a time invariant component η_j, then, under the assumption that the demand equation is linear,

$$\Delta M_{jt}^{D} = M_{jt}^{D} - M_{jt-1}^{D} = D_t^{dj}\left(\Delta p_{jt}, \Delta p_{Cjt}, \Delta X_{jt}^{o}, \Delta X_{Cjt}^{o}, \Delta M_{jt-1}, \Delta S_{jt}, \Delta I_{it}, \Delta \xi_{jt}\right) \tag{16}$$

which eliminates the time-invariant error term. Thus estimating the change in demand reduces the endogeneity bias if part of it was caused by the time-invariant component of the error term. If the error terms ξ_{jt} were not serially correlated, M_{jt-2} or ΔM_{jt-2} would be valid

instruments for M_{jt-1} or ΔM_{jt-1}. If the error term is serially correlated of order 1, M_{jt-2} or ΔM_{jt-2} would be correlated with ξ_{jt-1} and thus $\Delta\xi_{jt}$, which renders it unsuitable as an instrument. In this case M_{jt-3} or ΔM_{jt-3} unless the error terms are serially correlated of order two in which case an even deeper lag is needed**.**

4.2.3 Correlation between the Error Term and the Competitor's Choice Variables

Because each fund takes every competing fund's (C_{jt}) expected premium and non-mandated coverage into account when deciding on its own choice variables (see equations (11) to (13)), the equilibrium in the whole market with *N* funds is the outcome of a system of *3*N* interdependent equations.[94] Solving this system of equations for gives for each fund *j*

$$p_{jt} = p_t^j\left(M_{Nt-1}, S_{Nt}, \varepsilon_{Nt}^{uo}, W_{Nt}^o, W_{Nt}^u, I_{Nt-1}, f_\varepsilon^N, f_\gamma^N\right) \tag{17}$$

$$X_{jt}^o = x_t^{oj}\left(M_{Nt-1}, S_{Nt}, \varepsilon_{Nt}^{uo}, W_{Nt}^o, W_{Nt}^u, I_{Nt-1}, f_\varepsilon^N, f_\gamma^N\right) \tag{18}$$

$$X_{jt}^u = x_t^{uj}\left(M_{Nt-1}, S_{Nt}, \varepsilon_{Nt}^{uo}, W_{Nt}^o, W_{Nt}^u, I_{Nt-1}, f_\varepsilon^N, f_\gamma^N\right) \tag{19}$$

Let the vectors $M_{Nt-1} = \left(M_{1t-1}, M_{2t-1}, ..., M_{Jt-1}\right)$ and $f_\gamma^N = \left(f_{1\gamma}, f_{2\gamma}, ..., f_{J\gamma}\right)$. All other right hand side variables are defined accordingly. Therefore in the demand function of firm *j,* X_{Cjt}^o and p_{Cjt} are also potentially endogenous, because $C_{Jt} \in N_t$ and thus they depend on $\varepsilon_{Nt}^{uo}, W_{Nt}^u, \varepsilon_{Nt}^{uu}$ and γ_{Nt}, which contain $\varepsilon_{jt}^{uo}, W_{jt}^u, \varepsilon_{jt}^{uu}$ and γ_{jt}. Potentially the omission of X_{Njt}^o and p_{Njt} for those $N_t \notin C_{jt}$ (the not directly competing funds) can cause an omitted variable bias as well.

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[94] Even though any individual fund *j* directly competes only with $C_{jt} \in N_t$, all the non-competing funds $N_t \notin C_{jt}$ still indirectly impact the optimal choice of fund *j*.

The same variables that could serve as instruments, as described in subchapter 4.2.1, can be utilized as instruments for the competitors. If the effect of the own error terms and unobserved cost factors on a fund's choice variables clearly dominates the joint effect of those of all other funds, the endogeneity bias due to the interdependence within the market might be negligible.

5 The Sources of Contribution Rate Setting Power

The persistent contribution rate heterogeneity[95] indicates that funds experience contribution rate setting power. Possible sources of contribution rate setting power are product heterogeneity, switching costs or search costs. In this chapter, each of the three sources of contribution rate setting power are presented and discussed.

5.1 Product Heterogeneity

If fund characteristics like non-mandatory coverage and other non-contribution rate attributes have an impact on sickness fund choice and if they are the only source of contribution rate setting power, the market functions like the standard textbook model of monopolistic competition. The membership of any fund depends only on its contribution rate level, the level of all other relevant fund characteristics, the market size and the number of competitors, but not on the membership in the previous period.

5.2 Switching Costs

Switching costs consist of the time and monetary costs of the act of switching and the expected costs (or inconvenience) of getting used to the new fund, if switching has taken

[95] The standard deviation of the normal contribution rate in the data set declined only slightly from 0.951 in 1996 to 0.866 in 2002.

place.[96] In the context of the German sickness fund market, switching costs can be heterogeneous across time, individuals, and funds of origin or destination, or of any combination of these.

- Heterogeneity across time: Average switching costs are likely to decline over time. The advance of the Internet made the provision of contact information and forms to join another fund easier, thus reducing the time cost of switching. People have also learned from others who have switched funds previously, that the ways different funds operate are quite similar, and therefore the expected cost of getting used to a new fund has probably declined as well. Time invariant switching costs would cause switching to take place only (after the initial adjustment in the first year following the deregulation) if the relative contribution rate between funds changes. Declining switching costs would result in switching from more expensive to less expensive funds even if the relative prices remain constant over time. A widening of the contribution rate spread would accelerate switching, while a narrowing of the spread could either reduce switching or even prevent it altogether.
- Heterogeneity across individuals: If switching costs were homogenous across homogenous individuals, all members of a fund with the same choice set would react the same – remain in their current fund, or switch to the same fund. This is not observed, however. Moreover, given the people's different abilities to process information, incomes (and thus potential savings from switching), valuation of the time costs of switching, and to complete the required tasks for switching, it is reasonable to assume that switching costs are heterogeneous across people.

[96] This part of the switching costs has to be expected as it incurs only after the switching has taken place.

- Heterogeneity across funds of origin: As the process of leaving a fund is rather simple and standardized, it is reasonable to assume that the switching costs are homogenous across funds of origin.
- Heterogeneity across funds of destination: Switching costs are most likely heterogeneous across funds of destination, because funds attempt, with varying success, to make switching to them easy and thus reduce the costs of switching. For example some post the membership forms on-line and some send out targeted mail. Thus the fund with the lowest contribution rate is not necessarily also the only or even most popular switching destination.

In reality switching costs are likely heterogeneous across people and funds of destination that decline on average over time, but are homogenous across funds of origin. Given the heterogeneous distribution of branches and population[97], it is further reasonable to assume that for two individuals *g* and *h* that are currently members of fund *j*, two potential destination funds *k* and *l* and switching costs λ, $\lambda_{gk} > \lambda_{hk}$ and $\lambda_{gl} < \lambda_{hl}$. Thus the order of funds with respect to switching costs is not identical for all individuals.

The same applies for the interaction of time and individuals[98] or time and fund of destination.[99] Thus the switching costs can be written as

$$\lambda_{ijt} = \overline{\lambda} + \lambda_i^I + \lambda_j^J + \lambda_t^T + \lambda_{ij}^{IJ} + \lambda_{it}^{IT} + \lambda_{jt}^{JT} \qquad (20)$$

[97] This is not restricted to the pure geographic distribution, but has to be understood in a broader sense. For example some individuals are "closer" to one fund than another, because they know members or employees of that fund or for some reason they feel more comfortable about switching to one fund than to others.

[98] For example people that experienced deteriorating health might, against the trend, have increasing switching costs.

[99] For example, if a fund goes on-line, the switching costs for switching to this fund decrease faster than for other funds.

with $\bar{\lambda}$ being the average switching costs and the other terms are the individual, fund of destination and time variant deviations from the average as well as the deviation of their interactions.[100]

5.3 Search Costs

It is possible that not every person has complete information about all funds' characteristics at all times, and that acquiring information about funds requires time and/or monetary effort. If so, the individual might either make decisions with incomplete information about the funds that he considers[101] or choose only within a subset of the legally available choice set. If search costs are the only source of contribution rate setting power, every insured person strictly joins the fund with the lowest contribution rate that he is aware of and which is in his choice set.[102] Thus fund membership is a function of the fund's relative contribution rate rank and the fund's lagged membership[103] among all competitors, if the chance of an insured knowing a fund's contribution rate is independent of any fund characteristic. Realistically, however, certain fund characteristics may increase the likelihood of being in someone's aware set. The larger a fund is, the more likely it is that someone will hear about the fund through social interaction or the media. Funds with particularly low contribution rates are likely mentioned in the periodically published contribution rate surveys

[100] λ_{ijt}^{IJT} is omitted, because the other terms are sufficient to identify every individual's switching cost to any fund at any time.
[101] This applies if there is more than one fund parameter to know, for example in a mixed form of search costs and product heterogeneity.
[102] The subset of the choice set is called "aware set" for the remainder of this research.
[103] This is because every insured knows at least his own fund's contribution rate or if he does not know any fund's rate (not even his own), the likely default is that he remains in his current fund. Zok (2003) reports that a surprisingly large number of insured did not know their current fund's contribution rate.

that often list only the lowest rate funds for a market, and funds that change their contribution rate against the trend will also might also experience more media coverage than other funds.

6 The Data

The data set used in this research is a self compiled fund-level data set that contains membership data, contribution rates, markets of operation, mergers, and non-mandatory coverage information. This chapter contains an overview of the data collection procedure and the descriptive statistics of the various components of the data set. It concludes with a discussion of the potential instrumental variables and a first test of their validity. The statistics presented here include all available data points and not just the final data set that is used in the empirical work, because the size of the data set used depends on the specification and on the included variables.

6.1 Data Collection Procedure

The first goal was to obtain a data set frame that contains all funds that existed at some point between 1996 and 2002. The membership data are collected for the January 1st of each year, thus 1996 was the last year before the 1994 reform impacted fund membership. The year 2002 was the chosen as the last year, because the main part of the data collection took place in 2002 and early 2003. Subsequent attempts to collect data for 2003 and beyond yielded unsatisfying results and therefore 2002 remains the end year for this analysis. The data collection ended in early 2005.

Initial information sources to compile the data set frame were on-line surveys and lists obtained from the web pages of the national associations of the different types of funds.[104] Unfortunately, public (governmental) sources could not provide comprehensive lists of funds. Many funds did not exist at both the initial and final date. For these funds it was required to find the founding date and/or the merge date and destination. Several web sources delivered most of the necessary information.[105]

In the next step, every individual fund for which an email address existed was contacted by sending a questionnaire[106] to the public relations or the controlling department of the bigger funds and the CEOs of smaller BKKs. If no individual email addresses were available, the "info@" (or comparable) address was used. The questionnaire asked for January 1st enrollment numbers[107] and a complete history of contribution rates and markets of operation from 1996 to 2002. Initially an attempt was made to gather data on all three types of contribution rates for the entire time period with all dates of change. It became clear that historical data for the increased and reduced rate were not as readily available and consequently the focus shifted towards the "normal" rate only. For the markets of operation the funds were asked to identify the operational status for each of the 17 markets in all years. Furthermore each fund was asked whether other funds had merged with that fund, and if so, about the same data for all the former funds.

Since funds could set different contribution rates in the new and the old states until January 1st 2001, the data were collected separately for these two parts of Germany. If the contribution rate differed, only fund data that were reported separately for both the eastern

[104] See Appendix A
[105] The web sources were fund's web pages, newsletters, newspaper articles, commercial registries, and surveys that listed mergers.
[106] See Appendix B
[107] The enrollment numbers were asked for several subcategories that will be discussed in Chapter 5.3.

and the western states of Germany were used by entering the data as two observations. If the contribution rate was the same and data were only available for both parts of Germany combined, the data were entered as one observation.

Funds that did not respond to the initial email received several follow up emails over the next year, which were usually sent to alternating recipients within the fund to increase the likelihood of a positive response. The final response rate was about 15% to 20%. The majority of funds that did not provide any data simply didn't reply. Those that did reply but did not provide data cited heavy workload, no interest, no availability, or confidentiality reasons[108] for their negative response.

At the same time, all the statewide and federal organizations of the different types of funds were contacted as well, asking for the data for all of their member funds. The BKK state association of one western state (Lower Saxony) and the association that heads four of the five eastern states provided the contribution rates and enrollment data for all funds headquartered in their respective states. The IKK national association provided the same data, as well as information on the markets of operation for all of the IKKs. The BKK state association for North Rhine-Westphalia provided the contribution rate data for all BKKs from its state.[109]

Other major sources were contribution rate surveys that various sources published on the Internet or in print[110], some of which included further information such as the regions that the funds operated in and occasionally membership numbers. These web sources enabled the

[108] Some funds provided data after receiving a confidentially statement that their data would not be shared with third parties.
[109] Their data proved to be only almost complete.
[110] See Appendix A

creation of a reasonably comprehensive data set for contribution rates, particularly for the open funds.

After the initial follow-up period, the open funds were contacted again and asked for at least contribution rate and regions of operation data, because these variables are needed to construct the market environment for the funds for which membership data are available. A number of funds that would not provide membership data answered to this request.

The last step of the data collection was to contact those funds for which some data were available, but some crucial information was missing (e.g. for some funds from Lower Saxony the head association provided enrollment and contribution rate data, but not the regions of operation). About 50-60 funds were contacted by phone, with a success rate of about 60%.

The second part of the data set contains information on the non-mandated coverage and other service related data like accessibility, which were obtained from various consumer reports[111] and one Internet source.[112] These surveys compared the non-contribution rate attributes of between 81 and 188 of the open funds. Contacting individual funds that were left out of the surveys to obtain additional data did not seem feasible, because the likely reason for their omission in those surveys was their refusal to reply to the surveys' requests for information.

6.2 Number of Funds

The data set accounts for slightly more funds than the officially reported number. The second and third columns in Table 5 show the number of funds according to the official

[111] Finanztest (4/1998, 9/1999, 9/2000, 1/2002) and DMEuro (1/2002)
[112] www.billigekrankenkassen.de (2002)

numbers, and the number of unique funds in the data set. The fifth column shows the number of possible data points in the data set, taking into account that many funds have data points for both the old and new states.

Table 5: Number of Funds[113]

Year	Official (unique)	Data Set (unique)	Difference	Data Set (Data Points)
1996	619	648	29	716
1997	532	550	18	618
1998	460	472	12	540
1999	433	444	11	512
2000	398	411	13	480
2001	375	384	9	452
2002	340	348	8	413

Source: VdAK (2004) and own computations

The official number of funds and the numbers of funds in the data set differ systematically. The number of funds in the data set is larger in every year, with a declining tendency (see the fourth column). There are three possible reasons for that over count.

First, funds that existed at some point between 1996 and 2002 and for which no information is obtainable on whether or not they existed in 1996, are assumed to have existed in 1996. This potential over count will make the data set look less complete, but since no data exist for the over counted funds, the over count does not create any bias.

Second, it is possible that the official numbers are annual averages and not January 1st numbers. Since the number of funds declined over time, the annual averages would be less than the January 1st numbers in the data set.[114] Comparing the number of funds of the data set, broken down by type of fund (see Table 6), with the official numbers (not shown)

[113] These numbers exclude the non-competing funds (see Chapter 2.2).
[114] The official numbers are quoted several times, but it was not possible to obtain the original publication from the Ministry of Health. Usually the numbers are quoted as beginning of the year numbers. Since the exact number is of no real importance in any of the publications, it is possible that the authors did not double check and even quoted from each other.

supports the assumption of moderate over counting of the BKKs since all but seven miscounts happened to be over counted BKKs. Therefore annual averages versus January 1st numbers would explain why even in 2001 and 2002, years for which the data set should be very accurate, an over count, albeit smaller than in previous years, exists.

A third reason explaining the over count could be a reporting error of the official numbers. A small undercount exists for the IKKs in 1999 to 2002. Because the IKK's national association provided the complete numbers for its members, the difference from the official numbers might simply be a reporting error of the public source.

Table 6: Number of Funds in the Data Set by Type of Fund

Year	AOK	BKK	IKK	EK	All
1996	20	559	54	15	648
1997	18	475	43	14	550
1998	18	398	43	13	472
1999	17	372	42	13	444
2000	17	352	30	12	411
2001	17	329	26	12	384
2002	17	296	23	12	348

Table 6 breaks down the number of funds in the data set by type. Between 1996 and 2002 the number of funds declined by 46.3%. The number of AOKs that merged mostly before 1996 and the number of the EKs declined by less than the average rate, while the number of IKKs declined by more than the average rate (57.4%).

6.3 Membership and Enrollment Data

The questionnaire asked for enrollment data for January 1st of all years between 1996 and 2002, broken down by type of the insured. All the data that were asked for was easily

available from the monthly report sheets (K1) that all funds are required to file with the supervising authorities.

The funds were asked for mandatory members (as well as unemployed and students as subgroups of the mandatory insured), voluntary members, all non-pensioner members (the sum of all voluntary and mandatory members), pensioners, all members (the sum of pensioners an non-pensioners), insured family members and all insured (the sum of all members and insured family members). The reason for collecting students and unemployed separately from the other mandatory members is that neither students nor unemployed are subject to contribution rate related premium payments. Mandatory and voluntary members were asked for separately, because voluntary members have more relaxed switching rules and these groups differ systematically with respect of their average income. The data for retirees was requested separately, because they faced a different premium until 1998 and are not subject to contribution rate changes during the year since 1998.

Table 7 shows the number of data points that were collected for each subcategory and year. The "all members" data are between 30% and 44% complete (between 157 and 217 observations) and for all other membership categories except students and unemployed between 26% and 38% of the potential data were collected. The share of available data for students and unemployed is likely lower (20% to 29%), because some responding funds did not consult the officially filed forms but some other record that did not include these data. The share of data for insured family members is very low for 1996 and 1997, because the official report sheets did not include this information until 1998 and several funds reported that they simply no longer have these numbers on record. The

Table 7: Sample Statistics of Membership Data

Category	Year	Observations	Mean	Standard Deviation	Min.	Max.	Total Insured Captured in Data Set	Total Insured in Population	Share of Population Captured	Share of Funds Captured
Mandatory Members	1996	206	80,348.11	303,925.00	0	3,106,489	16,551,710	29,233,644	56.62%	28.77%
Mandatory Members	1997	180	89,501.63	324,088.80	2	3,164,568	16,110,293	29,049,072	55.46%	29.13%
Mandatory Members	1998	169	127,194.10	459,318.20	3	4,078,287	21,495,802	28,764,224	74.73%	31.30%
Mandatory Members	1999	166	123,629.90	418,952.90	4	3,909,063	20,522,563	28,863,647	71.10%	32.42%
Mandatory Members	2000	161	127,102.40	409,775.50	6	3,619,369	20,463,486	28,752,347	71.17%	33.54%
Mandatory Members	2001	123	131,195.50	328,908.20	8	2,028,942	16,137,046	28,580,066	56.46%	27.21%
Mandatory Members	2002	106	129,318.70	311,942.70	13	1,964,604	13,707,782	28,367,491	48.32%	25.67%
Students	1996	147	1,928.69	4,306.47	0	30,874	283,518			20.53%
Students	1997	123	2,717.86	5,305.14	0	34,713	334,297			19.90%
Students	1998	112	3,291.46	5,854.04	0	35,618	368,642			20.74%
Students	1999	107	3,731.75	6,355.06	0	35,006	399,297			20.90%
Students	2000	98	3,988.49	7,289.57	0	35,397	390,872			20.42%
Students	2001	96	4,124.34	7,720.99	0	43,269	395,937			21.24%
Students	2002	79	5,428.58	10,001.83	0	47,195	428,857			19.13%
Unemployed	1996	152	11,053.63	35,869.99	0	206,686	1,680,151			21.23%
Unemployed	1997	125	13,748.17	43,723.21	0	235,557	1,718,521			20.23%
Unemployed	1998	152	11,053.74	38,918.50	0	243,249	1,680,168			28.15%
Unemployed	1999	148	10,867.25	36,344.25	0	206,513	1,608,353			28.91%
Unemployed	2000	138	11,482.78	36,579.67	0	213,185	1,584,623			28.75%
Unemployed	2001	101	14,091.53	37,899.74	1	192,508	1,423,244			22.35%
Unemployed	2002	94	14,914.89	40,463.41	1	200,349	1,401,999			22.76%
Voluntary Members	1996	206	10,847.68	61,107.69	0	812,231	2,234,622	5,905,804	37.84%	28.77%
Voluntary Members	1997	180	13,016.57	67,651.99	0	839,116	2,342,982	6,034,828	38.82%	29.13%
Voluntary Members	1998	169	26,600.24	132,170.90	1	1,178,496	4,495,440	6,122,586	73.42%	31.30%
Voluntary Members	1999	166	25,167.22	119,369.90	2	1,198,947	4,177,758	6,247,044	66.88%	32.42%
Voluntary Members	2000	161	26,362.65	121,184.00	3	1,229,324	4,244,386	6,448,422	65.82%	33.54%
Voluntary Members	2001	123	27,898.26	120,431.00	3	1,254,010	3,431,485	6,556,029	52.34%	27.21%
Voluntary Members	2002	105	29,487.04	128,931.50	4	1,266,486	3,096,139	5,833,181	53.08%	25.42%
Members excl. Retirees	1996	206	92,315.58	360,792.70	13	3,918,720	19,017,009	35,139,448	54.12%	28.77%
Members excl. Retirees	1997	203	92,610.52	366,282.90	12	4,003,684	18,799,935	35,083,900	53.59%	32.85%
Members excl. Retirees	1998	197	133,784.80	536,152.20	13	4,986,010	26,355,605	34,886,810	75.55%	36.48%
Members excl. Retirees	1999	193	128,570.50	485,085.40	11	4,768,654	24,814,106	35,110,691	70.67%	37.70%
Members excl. Retirees	2000	184	134,891.80	482,092.30	15	4,434,250	24,820,091	35,200,769	70.51%	38.33%
Members excl. Retirees	2001	152	130,804.00	386,454.40	16	2,979,582	19,882,208	35,136,095	56.59%	33.63%
Members excl. Retirees	2002	134	126,624.30	375,085.70	20	3,022,986	16,967,656	34,200,672	49.61%	32.45%
Retirees	1996	206	40,389.93	143,382.2	0	1,089,540	8,320,325	13,787,400	60.35%	28.77%
Retirees	1997	207	40,981.11	151,269.1	0	1,093,437	8,483,089	13,894,708	61.05%	33.50%
Retirees	1998	199	52,391.56	191,218.3	0	1,625,718	10,425,920	13,956,626	74.70%	36.85%
Retirees	1999	195	52,691.96	191,899.5	0	1,681,006	10274,932	14,010,477	73.34%	38.09%
Retirees	2000	188	55,285.82	197,191.7	0	1,731,597	10,393,734	14,058,081	73.93%	39.17%
Retirees	2001	153	56,086.41	168,777.9	0	1,103,341	8,581,220	14,075,271	60.97%	33.85%
Retirees	2002	140	49,309.04	153,648.2	0	1,099,576	6,903,265	14,998,736	46.03%	33.90%
All Members	1996	217	126,430.20	484,243.90	13	4,984,015	27,435,353	48,926,848	56.07%	30.31%
All Members	1997	221	124,553.70	488,244.00	12	5,090,902	27,526,367	48,978,608	56.20%	35.76%
All Members	1998	215	172,666.70	684,996.40	13	6,611,728	37,123,340	48,843,436	76.00%	39.81%
All Members	1999	212	195,150.40	712,723.20	11	6,449,660	41,371,884	49,121,168	84.22%	41.41%
All Members	2000	209	199,258.70	701,584.00	15	6,165,847	41,645,068	49,258,850	84.54%	43.54%
All Members	2001	175	200,743.90	600,919.20	16	4,521,588	35,130,182	49,211,366	71.39%	38.72%
All Members	2002	157	160,958.30	471,110.10	20	3,363,476	25,270,453	49,199,408	51.36%	38.01%
Insured Family	1996	77	43,288.13	138,897.70	23	868,147	3,333,186	20,297,741	16.42%	10.75%
Insured Family	1997	115	61,398.30	190,420.00	0	1,390,949	7,060,804	19,993,346	35.32%	18.61%
Insured Family	1998	205	61,603.00	252,295.40	4	2,370,421	12,628,615	19,813,942	63.74%	37.96%
Insured Family	1999	205	80,599.80	291,265.00	5	2,286,530	16,522,959	19,660,055	84.04%	40.04%
Insured Family	2000	199	82,447.20	287,553.90	6	2,157,486	16,406,992	19,506,307	84.11%	41.46%
Insured Family	2001	166	84,108.47	260,788.30	4	1,950,869	13,962,006	19,307,614	72.31%	36.73%
Insured Family	2002	146	70,571.96	223,942.30	5	1,949,876	10,303,506	19,148,459	53.81%	35.35%
All Insured	1996	84	142,953.20	448,998.60	98	2,675,779	12,008,068	69,224,589	17.35%	11.73%
All Insured	1997	119	213,921.20	649,968.60	25	4,905,819	25,456,622	68,971,954	36.91%	19.26%
All Insured	1998	209	209,717.00	850,333.70	17	8,982,149	43,830,853	68,657,378	63.84%	38.70%
All Insured	1999	207	279,688.00	1,005,680.00	16	8,736,190	57,895,416	68,781,223	84.17%	40.43%
All Insured	2000	204	289,125.60	989,989.10	21	8,323,333	58,981,622	68,765,157	85.77%	42.50%
All Insured	2001	170	289,464.30	861,230.40	20	6,154,191	49,208,931	68,518,980	71.82%	37.61%
All Insured	2002	181	243,316.30	870,684.70	25	8,150,979	44,040,250	68,347,867	64.44%	43.83%

share of funds covered in the data set peaks in 2000, because one data source provided data for a number of funds for the years up to 2000. Because of the aforementioned possible over count the share of data known is likely to be larger than reported here.

Since there are data for most of the AOKs and EKs, which comprise most of the biggest sickness funds, the share of the number of members and insured in the data set is larger than the share of funds covered. Usually between about 40% and 85% of the insured in each category are captured in the data set. Unfortunately some of the largest funds didn't provide data for 2001 and 2002, which explains the dramatic drop of the share for the last two years.

6.4 Premium Data

Initially, an attempt was made to create a data set containing all three possible contribution rates, but for four reasons it seemed beneficial to focus on the "normal" rate that applies to those members that receive sick pay from their employer for the first six weeks and from their sickness fund thereafter. The first reason is data availability. Many of the surveys contained data only for the normal contribution rate. Also for funds that either didn't respond or ceased to exist, normal rates were more easily obtainable than the other rates. Second, over 85% of insured are subject to the normal rate and thus the normal rate should have the major impact on fund choice. Third, the three rates are highly correlated. Table 8 shows the correlation between the three different rates for the years 1996 to 2002. The correlation between the normal and the low rate is between 0.86 and 0.91 and between the normal and the high rate between 0.66 and 0.80. Therefore including the other two contribution rates should not add much, if any, explanatory power. The fourth reason is that adding two more

explanatory variables that are highly correlated will cause an unnecessary loss of degrees of freedom.

Table 8: Correlation Coefficient between Contribution Rate Types

Contribution Rate 1	Normal	Normal	Low
Contribution Rate 2	Low	High	High
1996	0.906	0.803	0.694
1997	0.867	0.737	0.592
1998	0.873	0.659	0.498
1999	0.866	0.687	0.554
2000	0.859	0.689	0.537
2001	0.861	0.690	0.556
2002	0.911	0.738	0.637

A variety of sources were used to collect the contribution rate data, including the sources mentioned above in Chapter 6.1 to collect membership data. Furthermore there were numerous other on-line sources like newspaper articles, lists provided by companies for their employees, reports in consumer forums, lists provided by charitable organizations, etc.[115] All these data sources were utilized wherever the premium was given with a specific date. There were very few instances where two sources gave conflicting information. In these cases the fund was contacted for clarification. As the premium data are open knowledge and the funds have an interest in publishing this information, it was possible to obtain an almost complete dataset for at least the open funds. Table 9 shows the descriptive data of the contribution rates for the funds in the data set.[116] The average contribution rate increased from 12.44% to 12.80% over the first two years and declined slightly to 12.74% in 2001. In 2002 it increased again to 13.09%.

[115] See Appendix A

[116] The averages here are unweighted and thus not comparable to the official statistic, which reposts the average weighted by fund size.

Table 9: Normal Contribution Rates – Descriptive Statistics

Year	Observations	Mean	St. Dev.	Min.	Max.	Share of Funds known	Share of Open Funds known
1996	363	12.44	0.951	9.5	14.9	50.70%	92.31%
1997	336	12.57	0.924	9.1	15.3	54.37%	88.13%
1998	333	12.80	0.834	10.5	15.3	61.67%	91.30%
1999	338	12.78	0.842	10.2	15.3	66.02%	92.61%
2000	351	12.77	0.836	10.2	14.9	73.13%	95.45%
2001	424	12.74	0.823	8.5	15.3	93.81%	98.11%
2002	413	13.09	0.866	8.0	14.9	100.00%	100.00%

The completeness of the data set increases from just below 50% in 1996 to 100% in 2002. The jump in 2001 is caused by the availability of data for virtually all BKKs for the last two years in the sample period. The degree of completeness is even higher for the open funds as it hovers around 90% for the first five years and reaches near completeness in 2001 and completeness in 2002.

6.5 Markets of Operation

A fund can take one of three operational states in a market: "*open*", "*closed*" or "*not active*". "*Open*" means that a fund is obliged to accept the application of any resident or employee, who has the legal right to be a sickness fund member. "*Closed*" means that only employees, their spouses and former employees of the firms backing the fund can be members of the closed fund. "*Not active*" means that a fund is not actively operating in that market.[117]

[117] Actually "not active" is not necessarily an option, but merely an estimate. A fund that is not active in a region can still have members living in that market, For example former employees that moved to another market or employees commuting to work across market borders. This might be a problem if a company close to the border of a market is employing many residents of the neighboring market. Since there is no information available for this effect this possibility is ignored altogether.

The questionnaire asked for the operational status of the fund in each of the 17 markets for January 1st of each year and the month of any switch from being *closed* or *not active* to *open* in the middle of the calendar year.[118]

The number of open funds increased rapidly over the years as can be seen in Table 10. Only in 2002 the number of open funds remained almost constant as the foundation of new open funds and the switching of existing funds to an open status barely outpaced mergers of open funds. The share of open funds increased continuously from about 17% in 1996 to 62.6% in 2002.

In the early years a sizeable number of funds have an unknown status, mostly because they merged with an open fund and it was no longer possible to obtain information about the former status of these funds. Since open funds have more media coverage and were likely to appear in premium comparison overviews, it is assumed that most of the unknown status funds were in fact closed. It is also possible that most of these unidentified funds did not exist in the early years and that they make up the bulk of the over counted funds, which were discussed above. To obtain a most complete data set some of the open status data were imputed, using the best guess possible.

For example, if fund ABC is backed by a small company from Bavaria and merged in 1999 with fund XYZ from Bavaria and fund XYZ opened itself to Bavaria only in 2001, we can conclude that fund ABC must have been a closed fund operating only in Bavaria. The open status of a fund was never imputed without reliable information of the open status.

[118] The data set includes 447 middle-of-the-year openings. Most of the opening took place at the beginning of the quarters (April, July and October)

Table 10: Open and Closed Funds by Type

Year	BKK (open)	BKK (closed)	BKK (unknown)	IKK (open)	IKK (closed)	All Open	All Closed	All
1996	68	451	40	6	48	109	499	648
1997	87	354	34	10	33	129	387	550
1998	106	268	24	11	32	148	300	472
1999	120	225	27	11	31	161	256	444
2000	151	182	19	14	16	194	198	411
2001	168	160	1	17	9	214	169	384
2002	169	127	0	20	3	218	130	348

Of all parts of the data set, the operational status part is the most complete one (see Table 11). The share of all funds for which there is complete information for all regions increases from 93.0% in 1996 to 100% in 2002. The share of data points for all funds increases from 96.2% in 1996 to 100% in 2002. For the funds that are known to be open the share of funds with complete data increases from 97.7% in 1996 to 100% in both 2001 and 2002. The share of known data points for these funds ranges from 99.4 to 99.7% in 1996 to 2000 and is 100% in both 2001 and 2002.

Table 11: Open Status Data Completeness

	All Funds		Open Funds	
Year	Share Complete	Share Data	Share Complete	Share Data
1996	93.03%	96.19%	97.69%	99.55%
1997	93.54%	96.86%	98.13%	99.63%
1998	94.09%	96.99%	98.37%	99.65%
1999	94.34%	97.25%	98.52%	99.68%
2000	95.21%	97.65%	98.35%	99.42%
2001	99.78%	99.99%	100.00%	100.00%
2002	100.00%	100.00%	100.00%	100.00%

To create variables for the competitive environment in which each fund operates, it is important to know the number of open funds in each market. Table 12 summarizes the number of open funds in each market for January 1st of each year. On average about 41 open funds competed for members in each market in 1996 whereas by 2002 the number increased to over 100 funds per market. This increase of about 150% is larger than the increase in the

number of open funds, because in addition to opening itself, many funds merged with funds operating in different markets so that the average number of markets per open fund increased from 6.4 in 1996 to 7.9 in 2002. There is a clear correlation between population size of the markets and the number of open funds available to its population. Only the six markets with the largest population also have more than 100 open funds each since the year 2000.

Table 12: Open Funds by State

State	1996	1997	1998	1999	2000	2001	2002
Baden-Wuerttemberg	51	61	72	88	106	116	121
Bavaria	54	73	82	98	112	123	127
Berlin	41	54	59	70	84	91	98
Brandenburg	36	47	51	60	70	75	80
Bremen	33	46	50	62	70	75	82
Hamburg	38	53	59	73	83	90	96
Hesse	52	66	73	86	103	116	118
Mecklenburg-Western Pomerania	32	43	47	57	68	72	79
Lower-Saxony	48	66	72	88	109	120	129
Rhineland	44	60	70	84	102	112	117
Westphalia-Lippe	46	60	72	88	105	116	125
Rhineland-Palatinate	38	51	57	69	82	92	97
Saarland	28	38	41	51	60	69	72
Saxony	41	52	59	72	86	93	99
Saxony-Anhalt	44	53	56	68	82	89	95
Schleswig-Holstein	30	43	47	58	68	77	85
Thuringia	38	52	55	66	80	91	96
Average	40.8	54.0	60.1	72.8	86.5	95.1	100.9

6.6 Non-Mandatory Coverage

Table 13 presents an overview of the scale and scope of the surveys that covered non-mandatory coverage. The focus of the survey questions differs between survey sources. While the financial consumer magazine Finanztest focused on accessibility issues as well as cost sharing schemes for certain treatments, the other financial magazine DMEuro and the web site www.billige-krankenkassen.de (thereafter bkk.de) reports predominantly listed all the non-mandatory model treatments that funds offer. Since some funds are entered

separately for the new and old states, the number of data points is larger then the number of funds that participated in the surveys.

Table 13: Overview of the Surveys of Non-mandatory Coverage

Source	Date	Number of participating Funds	Observation Points	Survey Content
Finanztest	4-1998	81	106	Number of branches Accessibility Spa visits Domestic sick care and household help Model projects
Finanztest	9-1999	115	144	Accessibility Spa visits Domestic sick care and household help
Finanztest	9-2000	188	241	Model projects
Finanztest	10-2002	167	206	Number of branches Accessibility Spa visits Domestic sick care and household help Model projects
DMEuro	1-2002	113		Model projects
bkk.de	1-2002	134		Model projects

The non-mandatory survey data are too multidimensional to capture all details without having to create too many variables and thus losing too many degrees of freedom, when estimating fund membership. Therefore a number of variables were created to capture as much information as possible. These variables are[119]:

- Access on Saturdays by phone (1998, 1999, 2002)
- Access on Sundays by phone (1998, 1999, 2002)
- Access via the Internet (1999)
- Share of cost for mother and child or mother recovery curative spa visits (1998, 1999, 2002)
- Homesick care entitlement (1998, 1999, 2002)
- Number of maximum weeks of homesick care per case (1998, 1999, 2002)

[119] The years for which these variables could be constructed are in paraphrases.

- Domestic help entitlement when sick (1998, 1999, 2002)
- Domestic help entitlement when sick and children present (1998, 1999, 2002)
- Model project participation index. (The index measure the percentage of total model project offered in which the fund participates in relation to the average surveyed funds. 1998, 2000, 2002)

6.7 Macro Data

The macro data needed to compute market size and market shares was mostly obtained from the Ministry of Health's publications and web page.[120] Unfortunately, the availability of consistent data over time is very limited. For example the market size information is reported in some years as annual average, in some years for beginning of a month, but not consistently for the same month. Hence the states' population numbers for January 1st of each year are used to estimate for each type of fund the enrollment in each state using the ratios (or the trend of the ratios) of the years for which there is comparable information.

6.8 The Instruments

Instruments are needed for the membership of funds, the contribution rates and any included non-rate fund attributes that are decided upon by the individual fund. An instrument has to fulfill the following criteria:

1) It must be correlated with the instrumented variable.
2) It must be uncorrelated with error term.

[120] See Appendix A

3) It must be available at a sufficiently disaggregated level so the instrument is heterogeneous across funds.

4) At least some instruments must be time variant.

6.8.1 Outside Instruments for Contribution Rate and Non-Rate Attributes

Likely candidates for the instruments for the contribution rate or non-rate attributes are variables that are either directly or indirectly related to the cost or revenue side of the individual funds and the health status or economic well being of the population. The fact that the risk structure adjustment negates most of the revenue per insured variation, makes it harder to find revenue related variables, but not necessarily impossible.

A major problem is point 3) above, because fund specific cost data exist only for a very limited number of funds and this cost data are hard to interpret, because of the risk structure adjustment.[121] Therefore all cost related instruments have to be indirectly related to a fund's cost, thus come from other (non-fund) sources and are therefore aggregated at a higher geographic level[122] than the individual fund.

6.8.1.1 The Cost Structure of the Funds

The cost of funds is comprised of

[121] For a limited number of funds annual reports, which often include cost data broken down into several categories, are available, but an attempt in 2003/2004 to compile a sufficiently extensive database of the costs data failed due to the reluctance of too many funds to provide these reports.

[122] The geographic aggregation levels are city, county, district (usually five to 20 counties, some states are comprised of one district only), region (applies only in North Rhine-Westphalia, which is the only state in which a fund can operate only in one half of the state) and state.

- Administrative costs (about 5% of total) that incur predominantly at the site of the fund's headquarters, but for funds with an extensive branch level also wherever the branches are located.
- Ambulatory care costs (about 26% of total) are negotiated between each fund and the physician's organization at the district level of the headquarters. It is basically a capitation fee that each fund negotiates for its members.
- Stationary care costs (about 35% of total): Hospitals charge the funds a mix of per diem and case-based lump sums. Major investments (construction, etc.) are usually financed with public funds at the state level while the sickness funds generally pay for the operating costs of the hospitals. Each hospital negotiates the different reimbursement rates with the head organizations of the sickness funds. Therefore geographic variation exists on the cost side.
- Other costs include pharmaceuticals, sick pay and other. Sick pay is a percentage of the income and should thus be correlated with the wage level of the location of the member. Prices for pharmaceuticals are uniform across Germany.

6.8.1.2 The Selected Instruments

The data for the instruments come from a number of sources. The population and area of the cities where a fund is headquartered were derived from the German Wikipedia site.[123] All socio-economic district and state data as well as hospital statistics were obtained from the

[123] See Appendix A. Municipal population numbers were only collected for 2004/2005, because no data source was available for complete annual population numbers from 1996 to 2002.

Statistische Bundesamt or Eurostat.[124] The smoking habits and body-mass-index numbers are part of the 2003 Mikrozensus.[125]

Per capita GDP is available at the county level for all years. It can be interpreted as a rough measure of per capita income, which should be correlated with pay roll cost for the funds' employees and possibly with the capitation fee for ambulatory care. Therefore per capita GDP should be positively correlated with cost and also the contribution rate. The problem with per capita GDP is that it greatly overstates the per capita income in the bigger cities that employ a lot of commuters and understates the per capita income of the surrounding counties. Unfortunately GNP is not available at the disaggregated levels. Fortunately very few sickness funds seem to be headquartered in suburbs – the vast majority are headquartered either in the big cities or in smaller centers so any bias is at least in the same direction for most funds. Per capita disposable income should be a superior measure, but is only available at the district level for all years. Also these indicators of the population's economic well being should be positively correlated with the fund's non-price attributes.

One problem with all of these variables is that they are also positively correlated with the fund's revenue side and thus negatively correlated with the contribution rate, because the RSA negates only 92% of the inter fund variation of the financial base from which funds receive their revenue. Whether the two effects are canceling each other or one dominates the other is a priori not clear.

Population and population density for the headquarters are available at the city and county level for 2005 only. There is likely a correlation between wage level and city population, especially because in Germany the suburbs are more likely incorporated than in

[124] See Appendix A
[125] See Appendix A

the U.S. Furthermore the population density of the city is likely correlated with the real estate prices which need to be paid for the headquarter unless it is owned by the fund. The problem with population numbers is that more populated cities tend to also have a higher population density and at the same time represent more potential members close to the fund headquarter, which in most cases also serves as a branch. Thus there could be a correlation between the instrument and the membership. Data for whether a county consisted of a single city are also available, which would give the county a higher population density by not including the surrounding less populated areas.

Hospital beds per capita and hospital admission rates are available at the district level for all years. The funds within a region finance the variable cost of the hospitals and thus either one of these variables should be positively correlated with hospital care cost and thus the contribution rate.

Smoking rates and BMI (body mass index) data exist at the state level for 2003. These variables are positively correlated with morbidity rates, and thus also with health care cost and thus the contribution rate. Also these instruments should be correlated with the non-price attributes, because members with a lower health status are more likely to demand broader services.

The cost and revenue side of a fund is obviously determined not only by the cost and revenue structure in the city/county/region/state where the fund is headquartered but in the entire geographic market of its operation. Therefore markets of operation-based instruments are constructed from variables that are available at the state level. The state's population serves as weights when computing the averages.[126]

[126] The desirable weights would be the share of each fund's members that is located in each market or state, but these data are not available.

An additional benefit of these markets of operation-based instruments is that using them adds variation to the predicted funds' contribution rates. If the location of the headquarters were the only determinant of the instruments, all funds that are headquartered in the same city would have the same predicted contribution rate. Table 14 shows all instruments, broken down by geographic aggregation level and whether they are computed for the region of the fund's headquarters or the entire market of operation.

6.8.2 Inside Instruments for Contribution Rates and Lagged Membership

If lagged membership is included in a specification, instruments are needed for these lags (see Chapter 4.2.2). One feasible instrument for membership levels is the 1996 membership level. Until 1996, most of the insured were members of an assigned fund and it can thus be assumed that fund membership in January 1st 1996 is exogenous. It is also possible to use sufficiently lagged changes in membership as instruments, depending on the presence and order of serial correlation of the error terms. If the 1996 membership is exogenous, so are the 1996 contribution rate levels and competitors' contribution rates and thus they could be used as instruments as well.

The major problems when using 1996 values for later years are potential mergers. Therefore two 1996 level instruments are created for the membership variable. One that takes the 1996 value for every fund for which that data are available, regardless of future mergers and one that takes the 1996 value until a merger happens. For the own contribution rate the 1996 rate was used as an instrument regardless of mergers, because a merger itself does not lift the rate to new level like it does with membership. The competitors' contribution rate

instrument is constructed by computing the average contribution rate of the currently open markets using the 1996 competitors' contribution rate.

Table 14: Available Instruments and their Geographical Aggregation Breakdown

Aggregation level	Headquarters	Market of Operation
Fund		Membership (1996)* Contribution Rate (1996)* Competitor's Contribution Rate (1996)*
City	Population* Dummy for county free city	
County	GDP per capita Population* Population density*	
District	Disposable Income per capita Hospital beds per capita Hospital admissions per capita	
Market (State or Region)	Casual smokers (share)* Regular smokers (share)* Strong smokers (share)* Former smokers (share)* Average BMI* BMI over 30 (share)* GDP per capita Disposable income per capita Hospital beds per capita Hospital admissions per capita	Casual smokers (share)* Regular smokers (share)* Strong smokers (share)* Former smokers (share)* Average BMI* BMI over 30 (share)* GDP per capita Disposable income per capita Hospital beds per capita Hospital admissions per capita

The instruments marked with "*" are available for one year only.

6.8.3 Validity of the Instruments

Instruments need to fulfill several conditions to be valid instruments.[127] First they need to be able to explain the instrumented variable as a whole. Second, each instrument needs to be correlated with at least one of the instrumented variables. Third, they need to be uncorrelated with the error term. Here only the first condition can be tested. The other conditions are tested following the different specifications in Chapter 0.

[127] Baum et al. (2003)

Table 15: R-Squared for Regression of all Instrumented Variables

Year	1997	1998	1999	2000	2001	2002
Own Contribution Rate	0.871	0.937	0.884	0.846	0.860	0.723
Competitor's Average Contribution Rate	0.961	0.994	0.991	0.988	0.971	0.975
Lagged Membership	1.000	1.000	1.000	1.000	0.999	0.996
Own Access on Sundays		0.609	0.704			0.568
Own Access on Saturdays		0.710	0.605			0.689
Own Domestic Help Entitlement w/o Children		0.731	0.702			0.574
Own Domestic Help Entitlement w/ Children		0.731	0.702			0.555
Own Homesick Care Entitlement		0.737	0.719			0.680
Own Homesick Care Max. Weeks		0.895	0.754			0.656
Own Web Presence			0.688			
Own Special Programs BKV						0.661
Own Special Programs FT		0.794		0.698		0.796
Own Special Programs DMEuro						0.678
Own Percentage Coverage Mother Spa Visits		0.756	0.700			0.513
Competitors' Access on Sundays		0.952	0.970			0.910
Competitors' Access on Saturdays		0.991	0.976			0.990
Competitors' Domestic Help Entitlement w/o Children		0.980	0.973			0.972
Competitors' Domestic Help Entitlement w/ Children		0.980	0.973			0.955
Competitors' Homesick Care Entitlement		0.973	0.980			0.919
Competitors' Homesick Care Max. Weeks		0.985	0.996			0.937
Competitors' Web Presence			0.977			
Competitors' Special Programs BKV						0.962
Competitors' Special Programs		0.976		0.845		0.967
Competitors' Special Programs DMEuro						0.951
Competitors' Percentage Coverage Mother Spa Visits		0.990	0.970			0.926

All variables that are potentially endogenous and thus have to be instrumented are regressed against exluded instruments[128] (see results in Table 15). For all variables the R^2 is very high, which is likely caused by the large number of instruments and the relatively small number of observations (typically between 50 and 60). In 17 of the 77 year/instrument combinations (all 17 are own non-price fund attributes), the F-test rejects the set of instruments at the 90% confidence interval. Therefore, even though the set of instruments as a whole appears valid for most potentially endogenous variables, for some the instruments it might fail to have sufficient explanatory power.

[128] Excluded instruments are instruments, which are not used as regressors.

7 Estimation

This chapter is organized as follows. For each of the three sources of contribution rate setting power, the implications on the actual estimation procedure are discussed and the decision made which variables to include in the estimation of sickness fund membership and the appropriate construction of the dependent and explanatory variables. Then the general membership without retirees (AKV) is estimated for each source of contribution rate setting power, controlling for heteroskedasticity, serial autocorrelation and endogeneity, and the results are interpreted. To conclude the chapter, the three models are "merged" to allow for joint sources of rate setting power and to test if one of the sources dominates the others.

7.1 Product Differentiation as the Source of Contribution Rate Setting Power

If product differentiation is the only source of contribution rate setting power, the individual's sickness fund choice problem could be seen as if every person is choosing next year's fund solely based on the price and non-price attributes of all available funds without even remembering which fund they had joined in the previous year. Thus a fund's membership is a function of its own and all competitors' contribution rate levels and the levels of all other fund attributes that are valued by at least some potential members, but is not a function of the past year's membership.

With M being the membership level, P the contribution rate and X representing all non-price attributes, and the subscripts denoting the fund j, the period t and J denoting all other funds that fund j competes with, fund membership can be expressed as

$$M_{jt} = \beta_0 + \beta_1 P_{jt} + \beta_2 P_{Jt} + \beta_3 X_{jt} + \beta_4 X_{Jt} + \varepsilon_{jt} \qquad (21)$$

Ideally every fund's price and all other attributes would enter each fund's demand equation, but then the number of regressors would exceed the number of observations. Therefore P_{Jt} and X_{Jt} have to be condensed in a meaningful way.

If all the funds operated in one market (instead of any combination of 17 distinct markets and therefore 131,071 possible permutations of markets) and given the large number of funds, each fund's competitors would be almost identical in terms of their average characteristics. The resulting lack of variation in competitors' contribution rates and non-rate attributes would render these variables irrelevant and the above equations could be reduced to only include the fund's own characteristics and not the competitors'. However, the fact that there exist 17 different markets with different average contribution rates and non-rate fund attributes allows the inclusion of the competitors' characteristics (P_{Jt} and X_{Jt}). Table 16 shows the range of the competitors average and minimum contribution rates. While the average contribution rate is within a narrow (0.27 percentage point) range[129] for all years since 1997, the competitors' minimum contribution rate has a larger range of 0.5 to 0.8 percentage points since 1997.[130] Thus for the competitors' contribution rate two sets of explanatory variables are constructed: First, the

[129] A 0.27 percentage point range is, however, equivalent to a 2.1% (and 5.4% in the extreme case) difference in average competitors' prices.
[130] One outlier in 1996 caused a 2.30 percentage point spread.

average average and second, the average lowest competitors' contribution rate.[131] The size of the markets are used as weights.

Table 16: Competitors' Contribution Rates

Average Competitors' Contribution Rate (Open Funds)					
Year	Observations	Mean	Minimum	Maximum	Range
1996	147	12.72	12.49	13.16	0.68
1997	179	12.63	12.56	12.75	0.19
1998	194	12.84	12.75	12.99	0.23
1999	211	12.80	12.73	12.94	0.22
2000	246	12.82	12.73	12.95	0.23
2001	288	12.83	12.71	12.98	0.27
2002	276	13.26	13.16	13.38	0.22
Minimum Competitors' Contribution Rate (Open Funds)					
Year	Observations	Mean	Minimum	Maximum	Range
1996	147	9.99	9.50	11.80	2.30
1997	179	10.97	10.60	11.40	0.80
1998	194	11.47	11.30	11.80	0.50
1999	211	11.31	11.00	11.80	0.80
2000	246	11.22	11.00	11.80	0.80
2001	288	11.37	11.20	11.80	0.60
2002	276	11.57	11.20	11.90	0.70

7.1.1 Alternative Dependent Variables

One problem is the difference in market size and number of competitors across funds. This is relevant information that would be lost if the average or most competitive competitors' attributes are used to describe P_J and X_J without including the market size or number of competitors either in the dependent variable or including additional explanatory variables. Here the first option is chosen and market size and the number of competitors is included in the dependent variable. Using market shares as an alternative measure for the dependent variable would incorporate the market size, but not the number of competitors. Thus two relative market

[131] For better readability the first "average is dropped thereafter and it is understood that now the average competitors' rate is the average across all markets of the averages within each market and the lowest competitor's rate is the average across the markets of the lowest competitors' rate within the markets.

share variables are used instead, which set the actual market share in relation to the market share that an average fund would have, given the number of competitors. Let

$$I_{jn} = \begin{cases} 1 \;\; if \;\; fund \;\; j \; is \; open \; in \; market \; n \\ 0 \;\; if \;\; fund \;\; j \; is \; not \; open \; in \; market \; n \end{cases} \tag{22}$$

and there are O_n[132] open funds as well as TM_n members in market n.[133] Then the average funds' average market share in all markets that fund j is open in, weighted by the size of the market (AMS_j) is

$$AMS_j = \frac{\sum_{n=1}^{N} \frac{I_{jn} TM_n}{O_n}}{\sum_{n=1}^{N} I_{jn} TM_n} \tag{23}$$

and fund j's overall market share in all open markets ($FAMS_j$) is

$$FAMS_j = \frac{M_j}{\sum_{n=1}^{N} I_{jn} TM_n} \tag{24}$$

Then the relative average market share ($RAMS_j$), which is the ratio of the own market share and the market share of the average fund, is

$$RAMS_j = \frac{FAMS_j}{AMS_j} = \frac{M_j}{\sum_{n=1}^{N} \frac{I_{jn} TM_n}{O_n}} \tag{25}$$

In the absence of any bias in the number of open funds, if the data were complete and if there were only open funds, the average *RAMS* should be close to 1. Larger values indicate larger funds and the minimum would be 0 for an existing fund without members.

[132] Throughout the remainder of this research, O_n is denoting the number of open known funds while J_n is the number of open funds with known contribution rate.
[133] For simplicity the subscript t is omitted throughout the development of the dependent variables.

Alternatively the difference between the fund's average market share and the market share of an average fund ($DAMS_j$) is

$$DAMS_j = FAMS_j - AMS_j = \frac{M_j - \sum_{n=1}^{N} \frac{I_{jn} TM_n}{O_n}}{\sum_{n=1}^{N} I_{jn} TM_n} \tag{26}$$

Under the same conditions as above the average *DAMS* should be close to 0. Values below 0 indicate smaller than expected average funds and values larger than 0 indicate funds that are larger than expected average fund. The summary statistics for both constructed dependent variables is shown in Table 17. The mean value for *RAMS* is much larger than the average for all funds would be expected to be, because larger funds are over represented in the data.[134]

Table 17: Summary Statistics for Dependent Variables of Product Differentiation

Variable	Observations	Mean	Std. Dev.	Min	Max
RAMS	648	3.574	9.250	0.000206	61.384
DAMS	648	0.0359	0.122	-0.0300	0.768

The major problem of both *RAMS* and *DAMS* is the measurement error in the number of firms O_n and the existence of closed funds. In detail these problems are:

- The existence of closed funds. TM_j is the total market size of all funds and thus the existence of closed funds causes a bias in the AMS_j, which does not take the closed funds into account.
- The fact that the number of open funds is self-computed. As can be seen in Table 11, the open/closed status is the most complete variable in the data set so that the undercount is unlikely to distort the results significantly.

[134] The share of members known is larger than the share of funds for which the membership is known. See Table 7.

- The data set's completeness increased over time and thus there could be a systematic undercount of the number of open funds in earlier years.

Since the measurement error is causing an undercount of the number of open funds, the *AMS* is biased upward. In the absence of a more precise measure, it is better to use this measure than to exclude the number of competitor's altogether, especially since the number of open funds varies greatly across states (see Table 12).

7.1.2 Non-Price Attributes

As described in more detail in Chapter 6.6, the non-mandatory coverage and other fund attributes other than the contribution rate are too numerous to all be included and thus need to be condensed without losing some information due to compression. Besides these non-price attributes a dummy that indicates "no survey participation" is also included. This dummy allows the inclusion of those funds that are not participating in the survey and the estimation parameter on the dummy can be interpreted as the average non-price attribute effect of the funds that are not captured in the survey.[135]

7.1.3 Estimations of the Product Heterogeneity Model

The results of the OLS regression with RAMS as the dependent variable for the full specification from equation (21) are shown in Table 18. The Breusch-Pagan test for heteroskedasticity rejects homoskedasticity at the 99.9% confidence level in all years except for 1996 and at the 94% confidence level in 1996. Thus the robust standard errors are used.

[135] These non-participants have a 0 and not a missing value recorded for the non-price attributes.

While the average R^2 is quite high (0.43), the highly significant parameter on the own price is unexpectedly positive in all sub samples, which is an indication that the initially large and expensive funds remain large and expensive. The parameter on cross prices is either positive or negative, depending on the sample, but rarely significant. The non-rate attributes are rarely significant factors in determining demand, with the exception of the special programs in 2000 and 2002, which shows the expected signs for both, own- and cross-effects and the home sick care entitlement, which displays a significant parameter with the wrong sign in all years. The results for the other potential dependent variables (total membership and *DAMS*) show essentially the same pattern. The coefficients on the own price and the R^2 for these dependent variables are presented in Table 19.

7.1.3.1 Parallel Own- and Cross-Effects

Usually own effects are found to be larger than cross effects, because the market demand is not perfectly inelastic. The total demand for German sickness fund coverage, however, is very, if not almost perfectly inelastic[136] and thus the total market demand would not change (much) if all funds increase their contribution rates by the same amount. Therefore it is possible that own and cross effects are exact opposites. Then, if the scalar *P* and the vector *X* that represent the equivalent variables for fund *j* and its competitors *J* have the same dimension, relative differences in prices and other attributes can be used. Thus equation (21) can be reduced to

$$M_{jt} = \beta_0 + \beta_{12}(P_{jt} - P_{Jt}) + \beta_{34}(X_{jt} - X_{Jt}) + \varepsilon_{jt} \qquad (27)$$

[136] This should hold true for a reasonable contribution rate range, because the vast majority of the members are mandatory members of a fund. Of the voluntary members, many could not find private insurance coverage, because of pre-existing conditions. If all sickness funds would increase their contribution rates within the normal framework, many others would never consider switching to the private sector, because of high age or too many dependents that would all need individual coverage in the private sector.

As can be seen in Table 18, the own and cross effects of any variable, including the contribution rates, have rarely if ever opposite coefficients of similar magnitude, and a parameter test for the H_0 that $\hat{\beta}_1 \neq -\hat{\beta}_2$ can be rejected in about half the sampled years. Estimating a simple specification with the relative price (own contribution rate minus the competitors' average contribution rate) delivers usually significant coefficients, but for all years and all dependent variables the sign is positive (results not shown).

7.1.3.2 Different Cross-Price Variables

The lowest competitors' contribution rate could be an alternative explanatory variable for the cross price, either instead of or in addition to the average competitors' contribution rate. Including the lowest competitors' contribution rate together with either only the own contribution rate and with both the own and average competitors' contribution rate yields parameters of either sign, but insignificant ones for all years (results not shown). The two cross rate variables are moderately correlated (0.55 for all years) and thus the inclusion of the lowest competitors' rate further diminishes the significance of the parameter on the average competitors' rate.

7.1.4 Fixed and Random Effects

There could be unobserved fund specific attributes that are not observed by the researcher but known and valued by the potential members. This suggests using a random or fixed effects model. If these unobserved attributes are correlated across time they would require the use of either fixed or random effects.[137] Then the correct equation to be estimated would be

[137] For example the location and density of the fund's branch system.

Table 18: Full Specification – OLS – RAMS

Survey	FinanzTest	FinanzTest	FinanzTest	FinanzTest	DMEuro	BKV
Year	1998	1999	2000	2002	2002	2002
Contribution Rate	3.74	3.62	3.99	2.32	4.18	3.72
	(1.46)**	(1.02)***	(1.15)***	(1.18)**	(1.64)**	(1.48)**
Average competitors' contribution rate	-27.12	-22.55	-18.1	-8.74	14.8	15.57
	(59.04)	(33.79)	(24.84)	(45.13)	(60.44)	(59.95)
Access on Saturdays	-0.773	8.13		6.03	1.32	2.52
	(3.92)	(3.72)**		(3.97)	(3.25)	(3.04)
Access on Sundays	-5.03	-11.75		-6.05	-0.516	-1.6
	(4.17)	(3.51)***		(4.30)	(3.97)	(3.84)
Percentage Coverage Mother Spa Visits	0.0214	0.382		-0.234	0.0623	0.0507
	(0.0583)	(0.113)***		(0.223)	(0.0515)	(0.0483)
Web Presence		1.86				
		(1.48)				
Homesick Care Entitlement	-6.22	-2.69		-10.36	-11.64	-11.5
	(3.05)**	(1.3)**		(3.27)***	(3.84)***	(3.78)***
Homesick Care Max. Weeks	-0.165	0.0906		0.0905	0.094	0.087
	(0.105)	(0.0268)***		(0.0537)*	(0.048)*	(0.0451)*
Domestic Help Entitlement w/ Children	8.69	-0.283		-0.956	-1.86	-1.23
	(6.00)	(3.14)		(5.12)	(6.34)	(5.85)
Domestic Help Entitlement w/o Children				1.71	3.43	3.89
				(3.18)	(3.94)	(3.64)
Competitors' Access on Saturdays	-87.77	-345.22		11.37	-61.02	-38.08
	(138.48)	(153.4)**		(211.7)	(251.36)	(271.42)
Competitors' Access on Sundays	64.76	342.97		205.13	219.13	245.65
	(144.79)	(160.66)**		(255.76)	(385.34)	(329.64)
Competitors' Percentage Coverage Mother Spa Visits	-0.191	-0.572		-0.587	-1.94	-0.681
	(1.12)	(2.23)		(4.67)	(9.47)	(6.73)
Competitors' Web Presence		-113.92				
		(95.03)				
Competitors' Homesick Care Entitlement	2.02	262.32		260.48	233.23	249.27
	(92.51)	(184.52)		(241.58)	(291.44)	(245.6)
Competitors' Homesick Care Max. Weeks	1.84	1.8		0.423	-0.745	-0.966
	(5.53)	(1.18)		(3.93)	(3.62)	(3.92)
Competitors' Domestic Help Entitlement w/ Children	-53.97	-5.09		-44.29	429.91	656.76
	(109.55)	(225.52)		(444.28)	(648.57)	(605.05)
Competitors' Domestic Help Entitlement w/o Children				-235.35	-477.19	-843.48
				(225.08)	(386.24)	(458.83)*
Special Programs FT (relative Participation Index)	-3.31		152.53	110.19		
	(2.38)		(32.53)***	(37.35)***		
Competitors' Special Programs FT (relative Participation Index)	30.91		-665.44	-616.58		
	(177.87)		(805.43)	(1512.12)		
In Survey – Finanztest		35.48	-5.41	-31.37		
		(9.14)***	(1.47)***	(24.43)		
Special Programs DMEuro (rel. Participation Index)					4.97	
					(2.27)**	
Competitors' Special Programs DMEuro (relative Participation Index)					-114.46	
					(218.74)	
In Survey – DMEuro					-5.23	
					(2.2)**	
Special Programs BKV (rel. Participation Index)						4.15
						(1.69)**
Competitors' Special Programs BKV (relative Participation Index)						-202.77
						(164.95)
In Survey – BKV						-3.77
						(2.03)*
Constant	340.17	168.74	182.41	167.55	-228.47	-267.66
	(746.79)	(439.15)	(312.04)	(594.55)	(773.97)	(774.66)
Observations	83	93	115	109	109	109
R-squared	0.493	0.672	0.462	0.52	0.432	0.432
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.						

Table 18 cont.: Full Specification - OLS – RAMS

Survey	All	All	All	All	All
Year	Pooled	1996	1997	2001	2002
Contribution Rate	4.13	3.78	4.35	5.57	2.67
	(0.43)***	(0.856)***	(1.08)***	(1.6)***	(1.16)**
Average competitors' contribution rate	-9.48	-1.67	-44.19	-34.22	62.05
	(4.1)**	(5.2)	(27.82)	(23.99)	(54.78)
Access on Saturdays	3.24				4.58
	(2.3)				(3.56)
Access on Sundays	-5.03				-3.59
	(2.62)*				(3.96)
Percentage Coverage Mother Spa Visits	0.0586				-0.259
	(0.0312)*				(0.261)
Web Presence	1.19				dropped
	(1.48)				
Homesick Care Entitlement	-6.84				-9.47
	(1.45)***				(2.74)***
Homesick Care Max. Weeks	0.0395				0.102
	(0.0224)*				(0.048)**
Domestic Help Entitlement w/ Children	-3.5				-0.246
	(3.91)				(5.38)
Domestic Help Entitlement w/o Children	4.56				1.91
	(2.67)*				(3.28)
Competitors' Access on Saturdays	4.41				30.3
	(72.14)				(214.57)
Competitors' Access on Sundays	-6.25				578.64
	(68.82)				(431.75)
Competitors' Percentage Coverage Mother Spa Visits	-0.0986				-14.73
	(0.436)				(10.34)
Competitors' Web Presence	37.33				dropped
	(27.77)				
Competitors' Homesick Care Entitlement	90.08				525.33
	(45.79)**				(361.98)
Competitors' Homesick Care Max. Weeks	-0.137				5.14
	(0.457)				(3.82)
Competitors' Domestic Help Entitlement w/ Children	45.38				1885.51
	(150.69)				(904.48)**
Competitors' Domestic Help Entitlement w/o Children	-100.7				-1208.8
	(110.02)				(482.5)**
Special Programs FT (relative Participation Index)	-0.52				89.16
	(3.63)				(30.48)***
Competitors' Special Programs FT (relative Participation Index)	3.43				2840.64
	(114.98)				(1655.96)*
In Survey - Finanztest	1.54				-30.14
	(1.96)				(27.26)
Special Programs DMEuro (relative Participation Index)	4.57				8.4
	(2.51)*				(2.71)***
Competitors' Special Programs DMEuro (relative Participation Index)	-107.46				1238.19
	(214.18)				(597.23)**
In Survey - DMEuro	-4.14				-6.98
	(2.21)*				(2.56)***
Special Programs BKV (relative Participation Index)	0.324				-3.45
	(1.23)				(1.77)*
Competitors' Special Programs BKV (relative Participation Index)	49.51				-1018.9
	(148.48)				(464.58)**
In Survey - BKV	1.4				2.12
	(1.97)				(2.14)
Constant	71.91	-24.62	505.48	371.3	-721.63
	(51.05)	(64.66)	(343.02)	(293.7)	(721.67)
Observations	631	49	74	108	109
R-squared	0.28	0.337	0.304	0.164	0.634

Table 19: Summary of Different Dependent Variables[138]

Total Membership						
Survey	FinanzTest	FinanzTest	FinanzTest	FinanzTest	DMEuro	BKV
Year	1998	1999	2000	2002	2002	2002
Contribution Rate	307672	228871	201229	98302.9	165815	136141
	(110356)***	(94988.8)**	(75164.1)***	(50336.6)*	(61878.8)***	(58617.8)**
R-squared	0.384	0.329	0.276	0.411	0.346	0.393
Total Membership						
Survey	ALL	ALL	ALL	ALL	ALL	ALL
Year	ALL	1996	1997	2000	2001	2002
Contribution Rate	218206	268219	257998	201229	193581	96883.5
	(27912.3)***	(73301.6)***	(76663)***	(75164.1)***	(58491.7)***	(53632.6)*
R-squared	0.163	0.089	0.086	0.276	0.151	0.517
DAMS						
Survey	FinanzTest	FinanzTest	FinanzTest	FinanzTest	DMEuro	BKV
Year	1998	1999	2000	2002	2002	2002
Contribution Rate	0.0618	0.0524	0.0461	0.0245	0.0403	0.0364
	(0.0247)**	(0.0148)***	(0.0129)***	(0.0106)**	(0.0141)***	(0.0128)***
R-squared	0.504	0.697	0.458	0.510	0.438	0.434
DAMS						
Survey	ALL	ALL	ALL	ALL	ALL	ALL
Year	ALL	1996	1997	2000	2001	2002
Contribution Rate	0.0624	0.106	0.086	0.0461	0.0548	0.0269
	(0.00612)***	(0.0247)***	(0.0219)***	(0.0129)***	(0.0148)***	(0.0107)**
R-squared	0.325	0.387	0.317	0.458	0.164	0.623
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.						

$$M_{jt} = \beta_0 + \beta_1 P_{jt} + \beta_2 P_{Jt} + \beta_3 X_{jt} + \beta_4 X_{Jt} + \tau_j + \varepsilon_{jt} \qquad (28)$$

Mergers potentially pose a problem when estimating random or fixed effects models, because a merger that does not result in the foundation of a new fund (and thus a new identifier for that fund) can cause a major shift of the unobserved non-price attributes of a fund.[139] Thus the estimation allows for two different fixed effects for a fund that was joined by other funds. Another problem is that a merger lifts the membership of the fund to a higher membership level. In this specification past membership is assumed to have no impact on current fund membership and thus this problem is assumed not to exist.

The fixed effects model is the only specification found that returned the expected (and significant) signs on both the own price and cross price effects as can be seen for the *RAMS* as

[138] For years for which non-price attributes are available.
[139] For example in the density of the branch network.

dependent variable in Table 20. For total membership and *DAMS* as dependent variables the estimated parameters on own price and for total membership and for *DAMS* on also on the cross price were opposite of the expected again (see Appendix C). The own- and cross non-rate attributes again have often the unexpected sign. Estimating both the fixed and random effects model without any non-rate attributes again results in the significant parameter estimates with the expected signs for the fixed, but not the random effects model. Surprisingly, for the fixed effect models (with and without non-price attributes) the cross price effect is substantially larger than the own price effect, which defies standard economic theory.

The Hausman specification test rejects the random effects model as a viable alternative for all three possible dependent variables. However the rank of the differenced variance matrix did not equal the number of tested variables. Careful search for the variables that need to be rescaled to fix that problem failed to identify all variables that need to be rescaled and thus the Hausman test statistic might find a local and not the global maximum.[140] For the reduced specification with only the own and cross- contribution rates the Hausman test soundly rejects the random effects model for all dependent variables.

Another more subjective criterion to decide between the fixed and random effects approach is based on the underlying assumptions of either approach. The random effect model assumes no correlation between the random effects and the explanatory variables, while the fixed effects specification does not have this restriction. Since it is very likely that the unobserved and the observed fund characteristics are correlated with each other, the fixed effects model should be the preferred specification.

[140] The results in Table 20 are shown for the variables before the rescaling was done, because several variables relate to each other (e.g. own and cross effects) and thus the parameters are easier to compare without selective rescaling.

Albeit being theoretically equally qualified as dependent variable *RAMS* appears to offer the better fit than *DAMS* and to reduce the number of permutations, the following analysis is carried out with only *RAMS* as the dependent variable.

7.1.5 Change of Membership as Dependent Variable

Unfortunately the non-price attribute surveys were not conducted every year. Therefore including the non-price attributes into the fixed effects model results in "0" values for most years.[141] Thus as an alternative approach the differences between each pair of years in which comparable surveys is tested.

$$\Delta M_{jt} = \beta_1 \Delta P_{jt} + \beta_2 \Delta P_{Jt} + \beta_3 \Delta X_{jt} + \beta_4 \Delta X_{Jt} + \Delta \varepsilon_{jt} \qquad (29)$$

The year pairs that can be constructed are 1999/1998 and 2002/1999. The model program coverage is excluded, because the different surveys (even by the same publisher) asked for quite different programs with greatly differing participation rates in the different surveys and thus the condensed variable loses it's meaning when it is differentiated.

The results for *RAMS* as dependent variable show a negative own price effect in the 2002/1999 sample, but also a negative cross price effect (see Table 21). In the 1999/1998 sample both parameters on contribution rates have unexpected signs. The parameters on own and cross non-price attributes are only significant in one case per sample and the parameters have the expected sign only about half the time. The R^2 is surprisingly high, but the small sample size and the large number of explanatory variables likely cause that. Because of perfect collinearity three explanatory variables were dropped in the 1999/1998.

[141] As mentioned before, there is a dummy variable included that captured the average effect of non-participation in the survey.

Table 20: Fixed and Random Effects – RAMS

Method	Fixed Effects	Random Effects	Fixed Effects	Random Effects
Contribution Rate	-0.794	0.626	-0.62	0.358
	(0.456)*	(0.313)**	(0.333)*	(0.304)
Average competitors' contribution rate	7.64	4.35	4.17	2.87
	(2.47)***	(1.98)**	(0.729)***	(0.719)***
Access on Saturdays	-0.771	0.66		
	(11.62)	(11.92)		
Access on Sundays	0.798	0.448		
	(1.21)	(1.38)		
Percentage Coverage Mother Spa Visits	-1.68	-0.427		
	(0.802)**	(0.777)		
Web Presence	-2.44	10.28		
	(34.34)	(37.84)		
Homesick Care Entitlement	-0.72	-1.27		
	(0.596)	(0.679)*		
Homesick Care Max. Weeks	-1.32	-0.962		
	(0.572)**	(0.826)		
Domestic Help Entitlement w/ Children	2.46	1.48		
	(1.03)**	(1.21)		
Domestic Help Entitlement w/o Children	-0.75	-0.123		
	(0.736)	(0.906)		
Competitors' Access on Saturdays	9.66	4.88		
	(31.1)	(40.4)		
Competitors' Access on Sundays	-7.7	-8.09		
	(32.22)	(38.49)		
Competitors' Percentage Coverage Mother Spa Visits	29.78	17.76		
	(22.15)	(16.34)		
Competitors' Web Presence	18.35	15.96		
	(9.99)*	(13.42)		
Competitors' Homesick Care Entitlement	0.62	5.41		
	(17.65)	(18.44)		
Competitors' Homesick Care Max. Weeks	-0.215	-0.16		
	(0.172)	(0.214)		
Competitors' Domestic Help Entitlement w/ Children	-11.05	13.97		
	(67.44)	(73.31)		
Competitors' Domestic Help Entitlement w/o Children	-21.36	-36.75		
	(50.93)	(61.91)		
Special Programs FT (rel. Participation Index)	-0.954	-0.715		
	(1.57)	(1.7)		
Competitors' Special Programs FT (rel. Participation Index)	23.18	25.04		
	(42.12)	(55.88)		
In Survey – Finanztest	0.62	0.474		
	(0.92)	(1.11)		
Special Programs DMEuro (rel. Participation Index)	3.17	2.83		
	(1.35)**	(1.56)*		
Competitors' Special Programs DMEuro (rel. Participation Index)	20.66	-27.86		
	(93.41)	(126.58)		
In Survey – DMEuro	-1.62	-1.64		
	(0.907)*	(1.01)		
Special Programs BKV (rel. Participation Index)	-15.62	-3.52		
	(32.27)	(43.31)		
Competitors' Special Programs BKV (rel. Participation Index)	-63.7	-19.11		
	(73.18)	(91.23)		
In Survey – BKV	0.606	0.798		
	(0.624)	(0.708)		
Constant	-83.68	-61.03	-42.06	-39.1
	(28.61)***	(24.31)**	(8.27)***	(8.38)***
Observations	631	631	647	647
Number of Different Funds	190	190	190	190
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.				

Table 21: Change in RAMS – OLS – Full Specification for Select Year Pairs

Year	1999/1998	2002/1999
Change of own CR	0.698	-1.39
	(0.27)***	(0.81)*
Change of avg. competitors' average CR	-5.85	4.61
	(23.33)	(13.62)
Change of Access on Saturdays	0.0314	-0.785
	(0.785)	(1.28)
Change of Access on Sundays	-0.0421	2.22
	(0.799)	(1.44)
Change in Percentage Coverage Mother Spa Visits	-0.015	-0.0368
	(0.0245)	(0.0181)**
Change of Homesick Care Entitlement	-0.0158	0.186
	(0.398)	(0.785)
Change of Homesick Care Max. Weeks	0.00791	-0.0446
	(0.00455)*	(0.0118)***
Change of Domestic Help Entitlement w/ Children	dropped	4.23
		(1.91)**
Change of Domestic Help Entitlement w/o Children	dropped	-1.38
		(0.865)
Competitors' Change of Access on Saturdays	-60.21	-37.64
	(50.89)	(90.75)
Competitors' Change of Access on Sundays	47.45	116.25
	(56.49)	(120.26)
Competitors' Change in Percentage Coverage Mother Spa Visits	0.749	-0.275
	(0.471)	(0.904)
Competitors' Change of Homesick Care Entitlement	1.3	-13.77
	(15.38)	(36.12)
Competitors' Change of Homesick Care Max. Weeks	0.0847	-0.241
	(0.11)	(0.428)
Competitors' Change of Domestic Help Entitlement w/ Children	-62.11	93.14
	(40.62)	(148.66)
Competitors' Change of Domestic Help Entitlement w/o Children	dropped	-26.3
		(110.74)
Observations	38	64
R-Squared	0.669	0.628
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.		

7.1.6 Endogeneity

In the product heterogeneity scenario, all the explanatory variables are potentially subject to endogeneity bias and need to be instrumented using the instruments discussed in Chapter 6.8. The 1996 membership level is excluded from the set of instruments, because it is clearly the instrument of choice for the lagged membership that is not included as an explanatory variable here and there is no reason to assume that a fund's generosity depends on its size. The full specification results for the fixed effects specification and *OLS*, both with and without instrumental variables and *RAMS* as the dependent variable are shown in Table 25 and for the individual years in Table 26. In both tables the reported parameter estimates differ from Table

20, because the sample used here is smaller to match the one used for the instrumental variable estimations.[142]

Also for this sample the fixed effects method is the only one that yields the expected (but not significant) sign on the own price parameter estimates. For the cross price variable parameter estimates both the fixed effects and random effects model yield the expected sign, but only the fixed effects approach yields the expected, albeit not significant sign also when instruments are used. For an unknown reason four of the non-price attributes are dropped in the instrumental variables-fixed effects approach. For the chosen sample these variables are neither constants nor perfectly correlated with any other explanatory variable. Regardless of the estimation method, all parameter estimates for the non-rate attributes are not significant.

The results for the reduced specification with only the price variables are found in Table 22 and Table 23. Again the fixed effects model is the only one that yields the expected sign on both the own and the competitor's contribution rate. Unlike in the non-IV approach the parameter estimates are both significant at the 95% confidence level.

Table 22: IV for Different Estimation Methods – Only Contribution Rates – RAMS

Method	FE	RE	OLS	FE-IV	RE-IV	IV
Contribution Rate	-0.237	0.585	4.61	-2.19	3.02	6.57
	(0.433)	(0.35)*	(0.474)***	(1.02)**	(0.879)***	(0.539)***
Average competitors' contribution rate	3.52	2.36	-5.06	10.12	3.54	-5.49
	(1.03)***	(0.979)**	(1.78)***	(1.74)***	(1.64)**	(2.67)**
Constant	-38.56	-35.48	8.47	-97.91	-82.31	-11.78
	(11.01)***	(11.58)***	(22.2)	(14.5)***	(14.99)***	(33.22)
Observations	517	517	517	517	517	517
Number of Funds	147	147		147	147	
R-squared	0.058		0.190			0.154
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.						

[142] The 1996 instruments are only available for 517 of the originally 631 observations.

Table 23: IV and OLS – Only Contribution Rates for RAMS and by Year

Method	IV	OLS	IV	OLS	IV	OLS
Year	1997	1997	1998	1998	1999	1999
Contribution Rate	4.82	4.06	5.99	4.91	8.5	6.51
	(0.941)***	(0.996)***	(1.19)***	(1.26)***	(1.55)***	(1.58)***
Average competitors' contribution rate	-36.19	-31.55	-47.46	-35.95	-87.59	-73.58
	(23.02)	(23.79)	(22.42)**	(25.83)	(30.83)***	(39.45)*
Constant	397.95	349.1	534.78	401.05	1014.76	861.26
	(285.01)	(294.06)	(279.04)*	(321.4)	(383.21)***	(491.1)*
Observations	66	66	69	69	76	76
R-squared	0.271	0.281	0.25	0.262	0.233	0.26
Method	IV	OLS	IV	OLS	IV	OLS
Year	2000	2000	2001	2001	2002	2002
Contribution Rate	8.62	6.21	6.72	6.91	8.51	4.88
	(1.54)***	(1.7)***	(1.66)***	(2.03)***	(1.81)***	(1.75)***
Average competitors' contribution rate	-61.35	-49.7	-48.29	-49.62	-35.96	-25.23
	(19.94)***	(30.74)	(19.86)**	(29.77)*	(19.39)*	(22.49)
Constant	679.39	561.08	536.76	551.39	366.35	272.88
	(247.31)***	(378.99)	(247.54)**	(363.19)	(251.79)	(281.75)
Observations	89	89	83	83	85	85
R-squared	0.207	0.242	0.244	0.244	0.074	0.161
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.						

7.1.6.1 Test for Endogeneity

The Hausman test for endogeneity is performed on the full as well as the price-only specification for the OLS and the fixed effects model (see Table 24). For the price-specification the null hypothesis of exogenous contribution rates is soundly rejected. For the full specification there is some indication of endogeneity for the fixed effects model, but none for the OLS approach. This indicates that while the contribution rates are endogenous, the non-rate attributes are potentially not.

Table 24: Test for Endogeneity – Product Differentiation

Method	Fixed Effects	IV	Fixed Effects	IV
Specification	Full	Full	Only Rates	Only Rates
Chi-sq (22 or 2)	26.88	2.82	26.89	64.06
p-value	0.060	1.000	0.000	0.000

Table 25: IV for Different Estimation Methods – Full Specification - RAMS

Model	FE	RE	OLS	FE-IV	RE-IV	IV
Contribution Rate	-0.517	0.942	4.26	-4.85	3.95	3.40
	(0.46)	(0.326)***	(0.461)***	(7.71)	(5.56)	(3.94)
Average competitors' contribution rate	5.95	2.67	-8.01	24.73	-8.04	-29.58
	(2.32)**	(1.83)	(3.96)**	(34.71)	(67.18)	(54.25)
Access on Saturdays	0.0191	0.288	4.20	-6.25	-14.34	44.46
	(1.17)	(1.22)	(2.26)*	(26.48)	(128.83)	(50.07)
Access on Sundays	0.609	0.0582	-6.57	12.77	3.44	-73.51
	(1.22)	(1.39)	(2.45)***	(29.66)	(127)	(53.21)
Percentage Coverage Mother Spa Visits	-0.00905	0.000129	0.0546	-0.159	-0.13	-0.591
	(0.0108)	(0.0125)	(0.0406)	(0.948)	(1.2)	(1.39)
Web Presence	-0.0411	0.247	1.78	30.01	37.00	14.11
	(0.328)	(0.393)	(1.52)	(60.22)	(158.82)	(70.81)
Homesick Care Entitlement	-0.594	-1.30	-7.04	1.28	-2.18	-2.21
	(0.657)	(0.689)*	(1.37)***	(20.71)	(67.86)	(25.73)
Homesick Care Max. Weeks	-0.00986	-0.00573	0.0357	-0.0619	0.224	0.479
	(0.00594)*	(0.00868)	(0.0233)	(0.403)	(1.17)	(0.621)
Domestic Help Entitlement w/ Children	0.961	-0.0215	-5.79	10.39	42.27	1.53
	(1.24)	(1.43)	(4.61)	(121.11)	(288.5)	(205.81)
Domestic Help Entitlement w/o Children	-0.449	0.558	7.12	1.12	-4.93	73.89
	(0.813)	(0.926)	(2.61)***	(46.16)	(169.78)	(118.24)
Competitors' Access on Saturdays	-3.54	-13.78	-77.5	-93.21	81.5	289.66
	(31.95)	(42.14)	(69.61)	(316.3)	(2871.15)	(1265.96)
Competitors' Access on Sundays	7.32	8.25	18.89	dropped	270.14	38.46
	(34.6)	(42.28)	(65.74)		(2246.04)	(1299.32)
Competitors' Percentage Coverage Mother Spa Visits	0.319	0.199	-0.0494	0.132	-6.65	3.5
	(0.232)	(0.194)	(0.443)	(8.6)	(21.43)	(9.46)
Competitors' Web Presence	16.39	12.80	32.67	-28.24	-284.24	435.79
	(10.49)	(14.32)	(29.67)	(375.64)	(1255.96)	(899.42)
Competitors' Homesick Care Entitlement	3.52	7.37	48.61	86.05	650.5	369.59
	(19.06)	(19.14)	(41.5)	(366.62)	(2349.88)	(813.82)
Competitors' Homesick Care Max. Weeks	-0.177	-0.0965	-0.1	1.01	7.26	-4.39
	(0.173)	(0.222)	(0.471)	(5.03)	(21.63)	(18.88)
Competitors' Domestic Help Entitlement w/ Children	-5.95	24.20	198.56	dropped	-968.3	-286.46
	(71.13)	(88.48)	(154.66)		(6939.52)	(3548.93)
Competitors' Domestic Help Entitlement w/o Children	-30.09	-49.08	-216.59	-49.6	1051.3	-412.84
	(58.76)	(77.5)	(125.7)*	(711.84)	(6148.11)	(3250.79)
Special Programs FT (Relative Participation Index)	-0.21	-0.0583	2.62	-18.25	-41.54	68.26
	(1.9)	(2.16)	(4.42)	(109.18)	(258.38)	(95.87)
Competitors' Special Programs FT (Relative Participation Index)	11.97	1.55	-94.98	dropped	-1405.39	-1295.77
	(49.06)	(61.17)	(113.52)		(4938.16)	(4110.57)
In Survey – Finanztest	0.000969	0.0138	1.34	9.28	25.05	22.98
	(0.983)	(1.22)	(2.11)	(18.03)	(61.95)	(50.07)
Special Programs DMEuro (Relative Participation Index)	2.69	2.28	2.52	8.14	10.31	7.38
	(1.25)**	(1.34)*	(1.83)	(48.75)	(122.57)	(95.46)
Competitors' Special Programs DMEuro (Relative Participation Index)	39.66	9.8	35.5	dropped	953.23	2421.57
	(103.56)	(136.96)	(198.89)		(4901.84)	(3803.02)
In Survey – DMEuro	-1.82	-1.54	-3.69	-1.39	-8.79	-9.46
	(0.854)**	(1.01)	(3.08)	(47.4)	(90.36)	(67.15)
Special Programs BKV (Relative Participation Index)	-0.11	-0.0487	0.0758	6.04	-10.02	-12.28
	(0.424)	(0.467)	(1.15)	(46.56)	(105.07)	(92.45)
Competitors' Special Programs BKV (Relative Participation Index)	-66.97	-29.33	-23.79	dropped	-113.31	-1778.72
	(77.95)	(100.79)	(155.31)		(2916)	(2255.24)
In Survey – BKV	1.25	0.951	1.27	-4.03	0.342	1.84
	(0.886)	(1.18)	(3.26)	(41.17)	(85.12)	(53.63)
Constant	-65.43	-43.54	51.31	-254.19	37.85	319.44
	(27.25)**	(23.29)*	(49.63)	(368.08)	(866.47)	(712.47)
Observations	517	517	517	517	517	517
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.						

Table 26: IV and OLS – Full Specification for RAMS and by Year

Method	IV	OLS	IV	OLS	IV	OLS
Year	1998	1998	1999	1999	2002	2002
Contribution Rate	3.97	2.49	5.44	3.13	2.72	3.80
	(1.59)**	(0.999)**	(2.71)**	(1.03)***	(3.24)	(1.62)**
Average competitors' contribution rate	14.26	28.84	-35.75	-28.58	-93.56	34.41
	(44.04)	(32.87)	(62.37)	(31.82)	(216.58)	(57.72)
Access on Saturdays	0.463	-0.358	7.31	8.68	13.76	3.97
	(6.05)	(3.61)	(7.13)	(3.47)**	(14.17)	(4.22)
Access on Sundays	-6.54	-6.1	-14.57	-11.04	-7.71	-4.01
	(7.17)	(4.22)	(8.00)*	(3.3)***	(14.28)	(4.79)
Percentage Coverage Mother Spa Visits	-0.057	0.0465	0.347	0.383	0.586	-0.299
	(0.121)	(0.0785)	(0.345)	(0.109)***	(1.17)	(0.346)
Web Presence			-0.607	2.54		
			(4.55)	(1.66)		
Homesick Care Entitlement	-4.29	-7.72	-4.02	-3.2	-1.42	-9.73
	(4.92)	(2.95)***	(6.69)	(1.27)**	(13.68)	(3.62)***
Homesick Care Max. Weeks	-0.251	-0.101	0.047	0.0848	0.018	0.119
	(0.31)	(0.107)	(0.0686)	(0.0307)***	(0.254)	(0.0669)*
Domestic Help Entitlement w/ Children			-17.12	1.31	-14.93	-4.17
			(26.18)	(3.57)	(42.35)	(8.89)
Domestic Help Entitlement w/o Children					9.27	5.61
					(24.00)	(4.49)
Competitors' Access on Saturdays	-39.81	-135.1	32.66	-381.51	552.47	-90.59
	(230.41)	(120.6)	(395.93)	(176.29)**	(916.75)	(219.48)
Competitors' Access on Sundays	-92.05	-35.66	-71.73	287.47	-2.86	219.74
	(205.78)	(100.67)	(365.75)	(182.76)	(835.22)	(326.57)
Competitors' Percentage Coverage Mother Spa Visits	-0.951	-0.966	-1.15	3.26	-12.37	-7.08
	(1.27)	(0.786)	(6.26)	(3.05)	(17.96)	(8.36)
Competitors' Web Presence			-65.7	-128.6		
			(149.16)	(94.28)		
Competitors' Homesick Care Entitlement	16.94	-13.74	186.71	6.51	295.49	160.44
	(135.84)	(94.09)	(277.42)	(146.63)	(623.14)	(227.6)
Competitors' Homesick Care Max. Weeks	10.42	11.19	1.73	0.438	14.24	6.47
	(10.64)	(5.51)**	(1.85)	(0.734)	(12.19)	(4.24)
Competitors' Domestic Help Entitlement w/ Children	19.24	29.94	13.73	-171.19	1495	1396.78
	(141.41)	(85.09)	(455.18)	(229.58)	(2025.9)	(900.05)
Competitors' Domestic Help Entitlement w/o Children					-1014.03	-1241.63
					(1030.37)	(589.93)**
Special Programs Finanztest (Relative Participation Index)	10.87	-2.55			77.25	75.5
	(11.03)	(2.54)			(63.73)	(37.68)**
Competitors' Special Programs Finanztest (Relative Participation Index)	-164.36	-106.11			2008.01	3193.33
	(158.57)	(118.98)			(4068)	(2281.43)
Special Programs DMEuro (Relative Participation Index)					1.01	6.54
					(9.42)	(2.79)**
Competitors' Special Programs DMEuro (Relative Participation Index)					1288.22	905.1
					(1102.8)	(570.95)
Special Programs bkv.de (Relative Participation Index)					6.82	-3.79
					(8.88)	(2.05)*
Competitors' Special Programs bkv.de (Relative Participation Index)					-1087.26	-777.42
					(754.19)	(447.49)*
In Survey - Finanztest	-13.83	-6.83	11.62	38.36	51.2	-36.67
	(12.05)	(7.65)	(41.45)	(8.93)***	(107.71)	(36.61)
In Survey - DMEuro					-0.818	-7.2
					(10.7)	(4.48)
In Survey – bkv.de					-0.249	1.81
					(10.82)	(4.56)
Constant	-205.58	-369.2	366.99	258.4	1198.73	-279.51
	(537.95)	(385.73)	(796.4)	(398.02)	(2612.37)	(724.51)
Observations	69	69	76	76	85	85
	0.452	0.605	0.564	0.69	0.283	0.633
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.						

7.1.6.2 Validity of the Instruments

The ability of the instruments to explain the instrumented variables has been established in Chapter 6.8.3. If the excluded instruments[143] have little explanatory power (are "weak"), the bias in the IV coefficients is expected to increase.[144] Stock and Yogo (2004) propose to use the Cragg-Donald F statistic to test for weak instruments. The test statistics for a number of specifications are shown in Table 27. For all tested specifications the null-hypothesis of the instruments being weak cannot be rejected if a 5% relative bias was tolerable. The full specification fixed effects-IV model could not be estimated with the stata command xtivreg2 that yields these test statistics, because of presumed collinearity in some instruments and resulting underidentification of the model. The command xtivreg, however executes the same method and specification without problem, but does not provide the test statistics. For the price-only specification the Anderson Canonical test rejects the null hypothesis of underidentification, while it fails for the full specifications.[145] The Sargan-Hansen overidentification tests the joint null hypothesis that the excluded instruments are uncorrelated with the error term and thus correctly excluded from the set of explanatory variables. However, the Sargan-Hansen test is known to be troublesome if a large set of instruments in used and the test statistic has to be interpreted with care.[146] For the price-only specifications the null hypothesis has to be rejected, while only for the full specification IV approach the instruments appear valid. Regressing the estimation errors of the full specification fixed effects results against the full set of instruments yields an R^2 of 0.43, which indicates that here the set of instruments is not valid either.

[143] Excluded instruments are those that are not included as exogenous regressors in the main equation.
[144] Hahn and Hausman (2002)
[145] Ideally one would want to reject the null for the Anderson canonical test and the null of the Cragg-Donald weak instrument test while one would want to fail to reject the null of the Sargan-Hansen overidenification test.
[146] Roodman (2006)

Table 27: Validity Tests for Instruments – Product Differentiation

Method	FE-IV	IV	FE-IV	IV
Specification	Full	Full	Prices	Prices
Year	All	All	All	All
Cragg-Donald Weak Instrument Test				
Critical Value (max. 5% Bias)	-	20.86	20.41	20.41
Test Statistic	-	0.01	2.91	15.28
Anderson Canonical Underidentification Test				
Chi-sq(4, 18 and 29)	-	0.37	54.14	343.54
P-value	-	0.985	0.000	0.000
Sargan-Hansen Overidentification Test				
Chi-sq(3, 17 and 28)	-	0.006	51.02	104.46
P-value	-	0.999	0.000	0.000

7.1.7 Conclusion for Product Heterogeneity

The fact that for all specifications, sub-samples and choices of dependent variables (other than the fixed effects model with *RAMS* as dependent variable) the own price effect is showing the unexpected sign and the low significance of the parameters on non-price attributes strongly suggests that the problem with this approach is not as much the correct choice of estimation technique, but that product differentiation is definitely not the single source of contribution rate setting power and it is likely that inertia exists in this market. Since the models that assume product heterogeneity as the only source of price setting power are wrongly specified, all tests for endogeneity and validity of the set of instruments have to be interpreted with care and a final conclusion can not be drawn until the model for sickness fund membership is correctly specified.

7.2 Search Costs as the Source of Contribution Rate Setting Power

If search costs are the dominant source of contribution rate setting power, every person will switch to the fund with the lowest contribution rate that is available and known to him and remain only in his current fund if no lower rate fund is known to be available. Therefore the

transition process between two years can be split into two steps: First, each fund member decides whether and how much to search and second, each person makes his switching decision based on his individual "aware set", which is the set of funds of that he knows the contribution rate.

Searching can be induced by a variety of factors. While individual searching behavior is beyond the scope of the data set, a contribution rate increase[147] could increase a fund's members' average likelihood of searching and a decrease in the contribution rate could decrease the average likelihood of searching.

The aware set always includes the members' current funds and the overall completeness of the aware set depends on the search effort and the easiness of obtaining contribution rate information. The distribution of the degree of completeness across the members is not known, but certain characteristics could make it more or less likely for a given fund to be included in a searcher's aware set. These characteristics are those that tend to make a fund better known through more media coverage or word-of-mouth recommendation, namely the market share (or size) of the fund, that the fund changed its contribution rate or that it was part of a merger.

7.2.1 Construction of the Explanatory Variables

Because searchers are switching to the lowest rate fund in their aware sets, the fund's relative contribution rate ranking among all competing funds is relevant in this scenario and not the contribution rate difference. A simple ranking variable has the major shortcoming of failing to reflect the greatly differing number of open funds and thus choices in each market. Thus a

[147] Another potential variable is the (positive only) growth of the fund in the previous period or periods. Fund growth in the last periods could indicate that at least some of the members have searched in the past and thus have lower search cost than the average population and are thus more inclined to search again in the future. This variable, however, poses also an identification problem that is not possible to overcome. If there are other sources of contribution rate setting power, especially product heterogeneity, the lagged membership growth could indicate that the fund is having time invariant treats that are valued and cause repeated growth.

relative ranking index (RRI_{ji}) for fund j with contribution rate rank k in a market n with J known open funds' contribution rates is constructed.[148]

$$RRI_{jn} = \frac{J_n - k_{jn}}{J_n - 1} \tag{30}$$

The aggregated RRI_j ($ARRI_j$) across all markets in which a fund is open is created for each fund as the weighted average RRI_j across all open markets, with the size of the markets (TM_n) as the weights. With I_{jn} being a dummy variable indicating whether a fund is open in market n

$$ARRI_j = \frac{\sum_{n=1}^{N} I_{jn} RRI_{jn} TM_n}{\sum_{n=1}^{N} I_{jn} TM_n} = \frac{\sum_{n=1}^{N} I_{jn} \frac{(J_n - k_{jn}) TM_n}{J_n - 1}}{\sum_{n=1}^{N} I_{jn} TM_n} \tag{31}$$

If members are aware of some subset of all legally available funds, the likelihood of a given fund being the lowest rate fund in this subset should be positively correlated with the fund's *ARRI*.

One problem is that the sum of all *RRI* in a market is increasing with the number of open funds. Therefore the relative weight of the *RRI* is inversely related to the number of open funds and the *RRI* in one market can have a quite different impact from the same *RRI* in another market. In a market of J funds, the share of the fund j's *RRI* of the sum of all *RRIs* (RRI_j^{adj}) is

$$RRI_j^{adj} = \frac{RRI_j}{\sum_{j=1}^{J} \frac{J-j}{J-1}} = \frac{RRI_j}{\frac{J}{2}} = \frac{2RRI_j}{J} \tag{32}$$

Thus the number-of-competitors adjusted *ARRI* ($ARRI^{adj}$), defined as the individual market size weighted average of all RRI^{adj} shares, should be a better measure for a fund's relative position across all markets and is constructed as

[148] Because most, but not all funds' contribution rates are known, J_n is better described as the number of open funds with known contribution rate in a market even though this is a potential source for some bias as the lower rate funds are more likely to be included in the data set. *RRI* is constructed such that it takes the value 1 for the lowest rate fund and 0 for the highest rate fund.

$$ARRI_j^{adj} = \frac{\sum_{n=1}^{N} \frac{2I_{jn}(J_n - k_n)TM_n}{O_n(J_n - 1)}}{\sum_{n=1}^{N} I_{jn} TM_n} \tag{33}$$

The variable O_n is the number of open funds in market n. Ideally O_n equals J_n, but due to the incompleteness of the data set, the *RRI* is computed with the open funds with known contribution rates and O_n is the number of funds in each market that are known to be open. There are likely systematic reporting biases between states[149], as some states' BKK head organizations provided comprehensive contribution rate data, while in other states all data stems from contacting funds individually. Using O_n instead of the number of funds for which the rate is known J_n therefore removes any bias due to systematic differences in the share of open funds with known contribution rates.

If some transformation $f(RRI_j)$, for example the average squared *RRI*, is used, the transformed adjusted *ARRI* ($TARRI^{adj}$) has to be computed as

$$TARRI_j^{adj} = \frac{\sum_{n=1}^{N} I_{jn} \frac{f(RRI_{jn})TM_n}{\sum_{i_n=1}^{O_n} f(RRI_{i_n})}}{\sum_{n=1}^{N} I_{jn} TM_n} \tag{34}$$

These transformations of the $ARRI^{adj}$ are used, because there is a priori no information about the comprehensiveness of the aware set. Given that funds other than the rate leaders in any market gain members and under the assumption of search costs being the only source of

[149] On average *J* is 87% of *O* with a range of 75.4% to 100% and increasing over time. The spread between states within a year is between 0 (all rates are known for open funds in 2002) and 15 percentage points in 1997 and 8 percentage points on average.

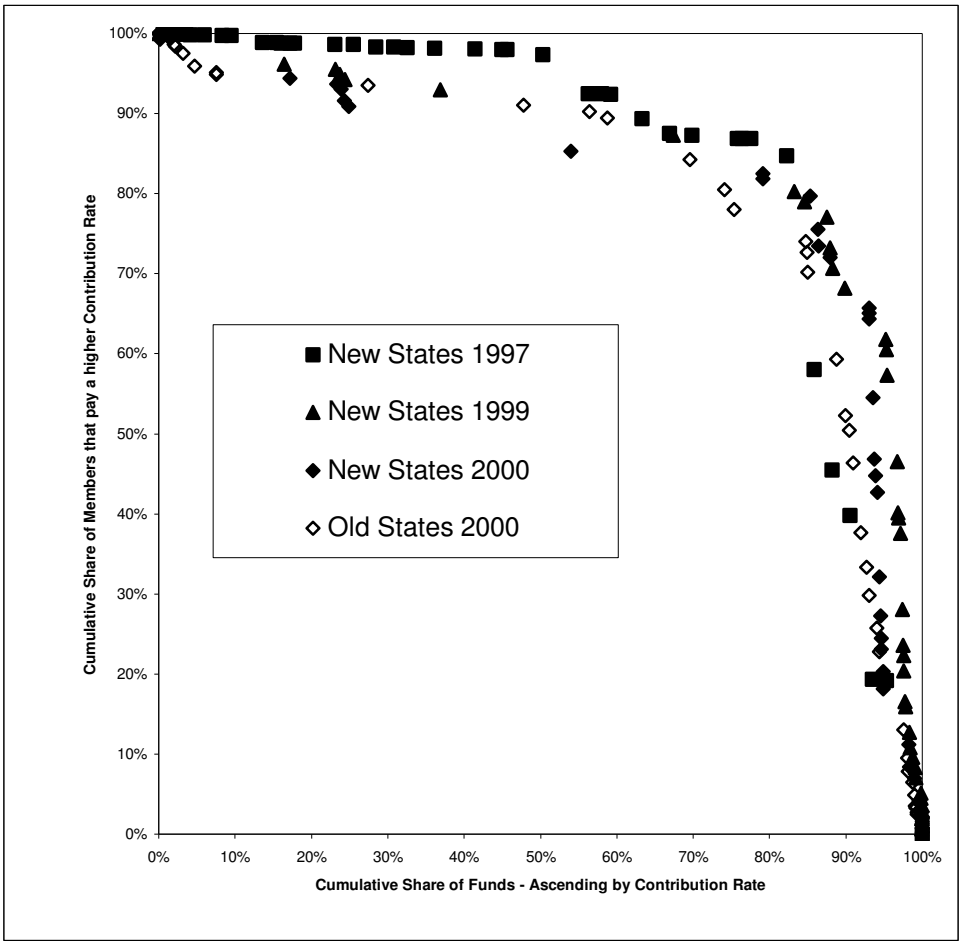
contribution rate setting power, the aware sets cannot be complete. However the degree of completeness determines the likelihood of any fund to the lowest rate fund in a person's aware set. Thus squaring the *ARRI* would increase the weight of the lower rate funds. As an extreme case, if all aware sets were complete, the fund with the lowest rate in a market would have to receive a transformed *RRI* of 1 and all other funds have a transformed *RRI* of 0.

The $ARRI^{adj}$ determines only a weight that a fund is assigned in its competition for switchers. Thus this weight has to be related to the fund's total market size (its source of potential switchers). However under the assumption of search costs, only fund members that pay a higher contribution rate are potential switchers and thus the number of members in other funds that pay a higher rate is the pool from which a fund could receive new members. While the total market size for each fund is included in the data set, the data set is not sufficiently complete to compute a useful number for the other funds' members that pay a higher contribution rate.

Fortunately, the official statistic provides data for the number of members aggregated by contribution rate for three years in the new and one year in the old states.[150] Figure 1 shows the cumulative distribution of members by funds. For all four samples, roughly 80% of the lowest rate funds insure about 20% of the members.[151] Thus, assuming that the market share of higher-rate members is approximately equal to the funds' relative contribution rate ranking is not feasible. Figure 1 also indicates that the cumulative share of members of the lower rate funds tended to increase over time.

[150] Bundesministerium fur Arbeit und Sozialordnung (1997, 1999, 2000)
[151] That is likely due to the fact that the EKs and AOKs are among the most expensive and largest funds.

Figure 1: Cumulative Membership Share



To construct the share of the market that charges a lower contribution rate for each fund, the official data is used to estimate this share from the *RRI*, the region and the year. The needed parameters for estimating the share for the data set were obtained from regressing the cumulative share of total members that pay a higher contribution rate (as shown on the vertical axis) against the cumulative share of funds (to the power of one to six), the interaction of all powers with the year[152] and with a region dummy. The reason why six is chosen as the highest power is that the explanatory power of the model did not increase anymore and that some regressors were dropped when using higher powers. The regression results are shown in Table 28.

[152] Year dummies would be preferred, but the use of dummies for the three years in the official data would not allow for a prediction in the remaining four years in the data.

Table 28: Cumulative Market Share – OLS

	N = 155	$R^2 = 0.983$
Variable	Coefficient	Standard Error
Fundshare	-1.57	1.35
$Fundshare^2$	17.26	15.54
$Fundshare^3$	-70.66	65.72
$Fundshare^4$	125.97	127.06
$Fundshare^5$	-100.25	114.03
$Fundshare^6$	28.16	38.55
Fundshare * Year	0.0100	0.29
$Fundshare^2$ * Year	-0.440	3.38
$Fundshare^3$ * Year	0.00203	14.40
$Fundshare^4$ * Year	4.75	27.93
$Fundshare^5$ * Year	-8.27	25.14
$Fundshare^6$ * Year	3.95	8.52
Fundshare * Region	0.0370	0.752
$Fundshare^2$ * Region	0.47	8.99
$Fundshare^3$ * Region	-5.45	38.72
$Fundshare^3$ * Region	20.09	75.43
$Fundshare^5$ * Region	-27.48	67.85
$Fundshare^6$ * Region	12.37	22.93
Constant	1.02	0.0150

The parameters from the above estimation are then used to predict the share of members paying a higher rate for the new and the old states. The share-of-the-market-times-$ARRI^{adj}$ [153]is then computed as the market size weighted average between the old and new states of the product of the $ARRI^{adj}$ and the share of market members paying a higher contribution rate and denoted as $SARRI^{adj}$. The $SARRI^{adj}$ also needs to be interacted with a dummy for a contribution rate decrease (or change), a merger and the size of the fund, because, as discussed above, these factors are positively related to receiving media attention and could therefore increase the likelihood of a fund being in someone's aware set. Also it should be distinguished between a fund's market (TM_{jt}) and the size of a potentially newly entered market (NM_{jt}). Being a newly open fund should decrease the likelihood of being known or being included in comprehensive rate overviews. Thus the baseline equation for search costs as the only source of contribution rate setting power is:

[153] Unless a clear distinction is necessary, $ARRI^{adj}$ is used synonymously for both *ARRI* and *TARRI*.

$$M_{jt} = \beta_1 M_{jt-1} + \beta_2 M_{jt-1} DRI_{jt} + \beta_3 M_{jt-1} DRD_{jt} + \beta_4 SARRI_{jt}^{adj} TM_{jt} + \beta_5 SARRI_{jt}^{adj} NM_{jt} + \beta_6 SARRI_{jt}^{adj} TM_{jt} DRD_{jt} + \beta_7 SARRI_{jt}^{adj} TM_{jt} DRI_{jt} + \beta_8 SARRI_{jt}^{adj} TM_{jt} DM_{jt} + \beta_9 SARRI_{jt}^{adj} TM_{jt} MS_{jt-1} + \varepsilon_{jt} \quad (35)$$

The coefficient β_1 measures the baseline retention rate, β_2 and β_3 measure the adjustment if fund *j* either increased or decreased its contribution rate with DRD_{jt} (DRI_{jt}) denoting a dummy that indicates a decrease (increase) in the contribution rate. The coefficients β_4 and β_5 measure the baseline allocation of switchers that pay a higher rate with respect to the size of the total market and new market. The interactions in β_6 to β_9 (DM_{jt} being a dummy indicating a merger and MS_{jt-1} denoting the market share in the previous period) are only carried out with the total market, because any new competitor is unlikely to receive as much media attention and word-of-mouth propaganda as incumbent funds.

7.2.2 Estimation of the Search Costs Model

The results of the full specification are presented in Table 29. Robust standard errors are used to control for heterogeneity.[154] Because of the inclusion of the lagged membership, the R^2 is 1 for all years. The baseline retention rate is below and close to 100%[155], but needs to be adjusted for the impact of rate changes (coefficients $\hat{\beta}_2$ and $\hat{\beta}_3$) on search behavior. These parameters show the expected sign (negative for $\hat{\beta}_2$ and positive for $\hat{\beta}_3$) in three of the 14 cases, even though they are significant in eight of 14 cases. In 1998, $\hat{\beta}_3$ is abnormally large, which is attributable to

[154] Stata does not allow for the Breusch-Pagan test if the constant is excluded. However for the full specification and all years the correlation between the size of the fund and the magnitude of the error term is 0.63, which indicates heterogeneity.

[155] The parameter on lagged membership can be interpreted as the retention rate for a fund that neither increased nor decreased its contribution rate and had no change in membership the previous year.

there being only six observations with a non-zero observation, three of which grew rapidly that year.

The parameter $\hat{\beta}_4$, the estimated coefficient on the interaction of $SARRI^{adj}$ and the total market size, is displaying the expected sign in all years and is significant in three of the seven years. The coefficient $\hat{\beta}_5$, the equivalent for the newly entered market is displaying the expected negative sign in six and is significant in four of the seven years.[156] The estimated coefficient $\hat{\beta}_9$ on the interaction of the lagged membership share is highly significant and displays the expected positive sign in all years. The remaining estimated coefficients strongly suggest the rate changes and mergers have no consistent and significant impact on the likelihood that a fund is in someone's aware set.

Table 29: Search Costs – Full Specification

Year	Pooled	1997	1998	1999	2000	2001	2002
B1 – Lagged AKV (in 100)	94.36	92.49	95.34	94.83	92.62	94.74	96.08
	(0.713)***	(0.501)***	(0.994)***	(0.611)***	(2.47)***	(1.05)***	(0.795)***
B2 – Lagged AKV if Rate increased (in 100)	1.81	4.94	0.35	1.95	1.90	3.00	1.78
	(0.822)**	(1.08)***	(1.04)	(2.67)	(2.06)	(1.03)***	(0.762)**
B3 – Lagged AKV if Rate decreased (in 100)	-1.18	-2.74	20.44	0.55	-1.15	-3.37	-1.08
	(0.591)**	(0.614)***	(20.04)	(1.28)	(3.19)	(0.466)***	(0.636)*
B4 - Adj. ARRI * Share * Total Market (in 1000)	36.46	159.54	13.69	41.94	17.68	72.55	14.43
	(7.92)***	(272.15)	(9.52)	(12.86)***	(30.84)	(30.94)**	(12.76)
B5 - Adj. ARRI * Share * New Market (in 1000)	-36.38	-46.50	89.89	-102.45	-9.81	-59.07	-26.84
	(11.33)***	(20.36)**	(101.77)	(54.5)*	(46.38)	(29.81)**	(17.07)
B6 - Adj. ARRI * Share * Total Market if Rate decreased (in 1000)	-1.93	-131.65	13.94	-100.41	-80.50	-43.24	12.36
	(12.96)	(272.61)	(12.25)	(98.89)	(91.41)	(31.81)	(20.05)
B7 - Adj. ARRI * Share * Total Market if Rate increased (in 1000)	-5.89	-178.87	18.26	181.73	-19.41	-101.13	9.09
	(19.18)	(272.51)	(15.29)	(62.41)***	(24.73)	(96.51)	(20.13)
B8 - Adj. ARRI * Share * Total Market if Merger happened (in 1000)	-18.53	131.82	-205.08	53.83	-1323.69	184.38	-34.28
	(14.47)	(257.29)	(109.65)*	(47.57)	(1516.22)	(433.84)	(34.59)
B9 - Adj. ARRI * Share * Total Market * Lagged Market Share	3997.78	5563.90	3688.69	3671.89	9186.02	3353.56	2697.85
	(436.8)***	(438.43)***	(1275.24)***	(600.53)***	(3922.47)**	(770.08)***	(501.27)***
Observations	521	55	70	86	104	104	102
R-Squared	1.000	1.000	1.000	1.000	1.000	1.000	1.000
R-Squared (Change in Membership)	0.719	0.799	0.820	0.899	0.686	0.659	0.636
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.							

[156] The sign is expected to be negative, because the newly entered market is also included in the total market size ($\hat{\beta}_4$). Thus the difference between $\hat{\beta}_4$ and $\hat{\beta}_5$ can be interpreted as the net effect of entering a new market.

When the change of total membership is used as the dependent variable, the estimated coefficients on lagged membership is reduced by 1 compared to the specification with membership as the dependent variable and should be interpreted as the average share of last year's members that do not search. The estimated coefficients on the other explanatory variables do not change, but the R^2 is now a better measure of the fit of the estimation. The R^2 for the specification with the change of membership as the dependent variable is always reported in the bottom of the applicable tables. In the full specification the R^2 is above 0.63 for all years. Because there is no compelling economic reason for a constant in this setting, it is omitted in all specifications.[157]

As explained in Chapter 7.2.1 it is possible that the *ARRI* will not have a linear effect if the switchers predominantly switch towards the funds with the very lowest rates. Therefore a "reduced" specification that only includes the variables with significant parameter estimates in the full specification is estimated for both the original *ARRI* and the squared transformation of it. The results are presented in Table 30. The overall fit of the model is comparable, but the estimated coefficient $\hat{\beta}_4$ is insignificant for four years and displays the unexpected negative sign in two of the years, while $\hat{\beta}_9$ is again highly significant with the expected sign in two of the years. Therefore the original adjusted *ARRI* is used as the preferred variable throughout the remainder of this research.

[157] Inclusion of the constant showed that it is in fact not significant.

Table 30: Search Costs – Reduced Specification with ARRI^2

ARRI							
Year	Pooled	1997	1998	1999	2000	2001	2002
B1 - Lagged AKV (in 100)	95.31	94.73	95.62	94.81	92.78	96.12	97.85
	(0.624)***	(0.999)***	(0.795)***	(0.643)***	(2.44)***	(1.01)***	(0.544)***
B4 - Adj. ARRI * Share * Total Market (in 1000)	33.3	10.23	21.01	51.27	5.49	60.36	21.83
	(6.62)***	(7.12)	(7.83)***	(20.48)**	(26.43)	(21.28)***	(12.18)*
B9 - Adj. ARRI * Share * Total Market * Lagged Market Share	3287.03	3310.9	3738.14	3773.15	8638.53	2266.07	2324.2
	(420.54)***	(577.72)***	(1377.25)***	(296.78)***	(3922.97)**	(747.98)***	(672.32)***
Observations	521	55	70	86	104	104	102
R-Squared	0.999	0.999	1.000	1.000	1.000	0.999	0.999
R-Squared (Change in Membership)	0.6657	0.6176	0.8135	0.880	0.6796	0.5431	0.544
ARRI-SQUARED							
Year	Pooled	1997	1998	1999	2000	2001	2002
B1 - Lagged AKV (in 100)	96.2	95.62	96.34	95.83	94.89	96.42	98.73
	(0.529)***	(0.697)***	(0.503)***	(0.605)***	(1.75)***	(0.76)***	(0.868)***
B4 - Adj. ARRI^2 * Share * Total Market (in 1000)	2838.82	-1897.1	-158.86	8719.67	56.71	9671	3975.98
	(1386.49)**	(1774.78)	(2357.73)	(4185.75)**	(5377.86)	(3870)**	(5004.06)
B9 - Adj. ARRI^2 * Share * Total Market * Lagged Market Share	1166320	1108990	1805620	1294570	2854980	1280000	839850
	(148198)***	(148322)***	(702260)**	(104914)***	(1113580)**	(334600)***	(478430)*
Observations	521	55	70	86	104	104	102
R-Squared	0.999	0.999	1.000	1.000	0.999	0.999	1.000
R-Squared (Change in Membership)	0.638	0.600	0.789	0.878	0.656	0.601	0.328

7.2.3 Instrumental Variables

All variables that are included in the estimation are suspected to be endogenous, because they include either the own contribution rate or the lagged membership (see Chapter 4.2). Therefore the full specification is estimated using the full set of instrumental variables as described in Chapter 6.8 on the entire set of dependent variables. The *ARRI* interaction with merger ($\hat{\beta}_8$) has to be dropped, because for none of the merged fund the 1996 instruments are available for all predecessor funds. Exogeneity can only be rejected for the pooled sample (see Table 31).

The Anderson Canonical test fails to reject the null hypothesis of underidentification for all samples and with the exception of 1998 the Sargan-Hansen test of no correlation between the instruments and the error term, which could be caused by the large number of instruments as discussed above. No critical values are reported for the weak instrument test, but it can be safely assumed that they are higher than the reported test statistic. At first glance these tests appear devastating for the chosen instruments, but some explanations are possible. The set of potentially endogenous variables is highly constructed and includes components that are unlikely to be endogenous. Thus to the degree that the

endogenous variables (contribution rate, competitors' contribution rate, lagged membership) are only playing a minor role in these explanatory variables, the less likely the instruments will do a good job explaining them.

Table 32 indicates that those variables with the least significant parameter estimates are also those that the instruments are least able to explain.

Table 31: Search Costs – Endogeneity and Validity Tests – Full Specification

Year	Pooled	1997[158]	1998	1999	2000	2001	2002
Hausman Endogeneity Test							
Chi-sq(7)	42.31	3.71	2.47	4.77	5.73	7.07	6.66
p-value	0.000	0.592	0.872	0.688	0.572	0.422	0.353
Weak Instrument Test							
Critical Value (max. 5% Bias)	NA	NA	NA	NA	NA	NA	NA
Test Statistic	0.353	0.339	0.329	0.232	0.176	0.453	0.218
Anderson Canonical Underidentification Test							
Chi-sq(24)	11.95	23.45	23.885	18.025	11.742	25.316	12.748
p-value	0.981	0.607	0.526	0.802	0.983	0.389	0.970
Sargan-Hansen Overidentification Test							
Chi-sq(23)	21.186	29.546	36.431	24.417	35.465	22.583	20.849
p-value	0.570	0.242	0.050	0.381	0.467	0.485	0.590

Table 32: Search Costs – First Stage Regressions

Variable	R^2	F(31, 278)	P-value
Lagged AKV	0.998	2917.92	0.0000
Lagged AKV if Rate increased	0.355	6.59	0.0000
Lagged AKV if Rate decreased	0.211	2.65	0.0000
Adjusted ARRI * Share * Total Market	0.708	14.74	0.0000
Adjusted ARRI * Share * New Market	0.200	2.30	0.0002
Adjusted ARRI * Share * Total Market if Rate decreased	0.245	3.16	0.0000
Adjusted ARRI * Share * Total Market if Rate increased	0.338	4.71	0.0000
Adjusted ARRI * Share * Total Market * Lagged Market Share	0.535	11.7	0.0000

Therefore a reduced specification is estimated which only includes the variables that are usually significant and display the expected sign in Table 29. The test results for endogeneity and the validity of the instruments in Table 33 show that in four years the null hypothesis under the Anderson canonical test can be rejected and the null of the Sargan-Hansen test fails to be rejected

[158] The lagged membership and its interaction with contribution rate changes are treated as exogenous in 1997 and the degrees of freedom are adjusted accordingly.

in five of the samples. The Cragg-Donald test indicates for all years that the instruments are weak.

Table 33: Search Costs – Endogeneity and Instrument Validity Tests – Reduced Specification

Year	Pooled	1997	1998	1999	2000	2001	2002
Hausman Endogeneity Test							
Chi-sq (2)	8.03	5.5	3.3	1.91	2.87	1.57	1.94
p-value	0.018	0.064	0.192	0.386	0.239	0.457	0.370
Cragg-Donald Weak Instrument Test							
Critical Value (max. 5% Bias)	20.31	11.05	20.31	20.31	20.31	20.31	20.31
Test Statistic	0.928	0.474	1.512	1.017	1.773	1.154	0.908
Anderson Canonical Underidentification Test							
Chi-sq(29)	30.431	27.94	65.181	52.064	66.38	50.191	41.054
p-value	0.393	0.521	0.000	0.005	0.000	0.009	0.068
Sargan-Hansen Overidentification Test							
Chi-sq(28)	64.332	22.695	35.32	33.13	42.455	38.233	34.846
p-value	0.000	0.748	0.161	0.231	0.039	0.094	0.174

The result for the pooled sample of the Sargan-Hansen test suggests that the instruments are not orthogonal to the error term. Thus the partial correlation coefficient between the error term and all instruments is computed and tested whether or not it is significantly different from 0. Twelve instruments for which the null hypothesis of no correlation with the error term is rejected at the 90% confidence level are excluded. The test statistics of the following estimation with the full sample and the reduced set of instruments again indicates orthogonality. Thus the same procedure was repeated and an additional five instruments excluded. The final estimation showed no further indication of endogenous instruments, but the Anderson canonical test continued to suggest underidentification and the instruments remain weak. This is somewhat surprising, because the F-statistics for regressing the endogenous variables on the instruments are all high and each instrument is highly significant in at least one of the three regressions.

7.2.4 Fixed Effects and Autocorrelation

There can be systematic fund specific differences, which cause some funds to be better known than others that are not captured in the data set. Funds might also differ systematically in their ability to influence their members' desire to search, which suggests estimating the model as fixed effects. Furthermore including the lagged membership without properly accounting for autocorrelation causes a dynamic panel bias and applying fixed effects only removes the fixed part of it. Therefore the one-step system GMM is also performed. While OLS tends to cause an upward bias of the estimated coefficient for the lagged variable, the opposite is true for the fixed effects, so that the two parameter estimates are roughly defining the range in which the true parameter should be.[159]

Table 34: Search Costs – Full Specification – All Methods

Method	OLS	OLS-IV	FE	FE-IV	GMM	GMM-IV
B1 – Lagged AKV (in 100)	94.36	93.42	93.57	85.32	93.99	94.34
	(0.779)***	(0.943)***	(6.17)***	(31.82)***	(0.108)***	(0.111)***
B2 – Lagged AKV if Rate increased (in 100)	1.80	3.39	1.21	-2.49	2.00	1.63
	(0.806)**	(2.28)	(0.48)**	(14.48)	(0.129)***	(0.138)***
B3 – Lagged AKV if Rate decreased (in 100)	-0.998	-1.36	-2.57	-6.29	-1.15	-1.20
	(0.597)*	(4.17)	(0.834)***	(13.03)	(0.232)***	(0.262)***
B4 - Adj. ARRI * Share * Total Market (in 1000)	36.26	354.21	-22.66	343.15	33.64	41.94
	(9.82)***	(169.31)**	(26.16)	(1578.11)	(10.43)***	(11.08)***
B5 - Adj. ARRI * Share * New Market (in 1000)	-37.72	-120.33	-12.5	270.9	-30.73	-29.6
	(11.69)***	(246.82)	(10.77)	(1155.08)	(22.76)	(20.7)
B6 - Adj. ARRI * Share * Total Market if Rate decreased (in 1000)	-2.21	-344.84	9.5	40.44	-4.74	-19.98
	(13.24)	(267.46)	(12.2)	(1646.49)	(20.68)	(20.07)
B7 - Adj. ARRI * Share * Total Market if Rate increased (in 1000)	-6.17	-529.74	-3.18	-1766.67	-5.5	-10.06
	(19.48)	(303.86)*	(16.33)	(4860.22)	(18.95)	(19.26)
B9 - Adj. ARRI * Share * Total Market * Lagged Market Share	3998.71	4518.27	4194.02	4312.92	4264.62	3991.02
	(466.75)***	(1493.91)***	(576.73)***	(11410)	(115.77)***	(144.99)***
Observations	521	309	480	293	521	428
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.						

The estimation results for the full specification (without the merger-*ARRI* interaction) for OLS, fixed effects (FE) and one-step system GMM (GMM) with and without instruments are presented in Table 34. The chosen instruments are those that were proven to be orthogonal for the pooled cross-section specification above. The Hausman test rejects endogeneity for OLS and

[159] Roodman (2006)

GMM, but not for the fixed effects model. In the GMM model this test is to be understood for the outside instruments and not the lags so it is not properly a test for endogeneity. The Arellano-Bond test for first order autocorrelation rejects the null of no autocorrelation for both the GMM and the GMM-IV method (z = -5.33 and –7.59), but the test for second order autocorrelation fails to reject the null only for the non-IV method (z = 1.27 and 2.12).

With the exception of the FE-IV approach, the parameter estimates for lagged membership are in a very narrow bandwidth. As expected the GMM parameter estimate is in between the FE and OLS ones.[160] The estimate suggests that on average about 5% to 6% of a funds members search each year. The fixed effects method shows a rare unexpected negative sign on the $\hat{\beta}_4$ and a very large and statistically insignificant one when instruments are used. Because it appears to be a good compromise between the biased OLS and FE estimators, the focus is on the GMM methods.

For either GMM approach, the estimated parameters $\hat{\beta}_2$ and $\hat{\beta}_3$ are consistently of the unexpected sign, even though they are significant in all non-IV and the GMM-IV approach. The estimation parameter on the main contribution rate related variable ($\hat{\beta}_4$) is highly significant and, as expected, positive. The corresponding parameter $\hat{\beta}_5$ is, as expected, negative and smaller in magnitude than $\hat{\beta}_4$, which indicates a small positive effect in newly entered markets. Changes of the contribution rate have no clear or significant effect ($\hat{\beta}_6$). The size of the fund has a large and significant positive effect on being in someone's aware set ($\hat{\beta}_7$).

[160] The estimated parameter and standard error for the GMM model has to be rescaled by the factor 100 to be comparable to the other estimation methods.

Table 35: Search Costs – Reduced Specification – All Methods

Method	OLS	IV	FE	FE-IV	GMM	GMM-IV
B1 - Lagged AKV (in 100)	95.31	93.79	95.31	80.7	94.71	94.9
	(0.724)***	(1.03)***	(8.98)***	(5.61)***	(0.0947)***	(0.0862)***
B4 - Adj. ARRI * Share * Total Market (in 1000)	33.3	39.65	-15.79	-102.69	43.24	49.89
	(7.64)***	(20.69)*	(18.13)	(69.11)	(9.54)***	(8.29)***
B9 - Adj. ARRI * Share * Total Market * Lagged Market Share	3287.03	5547.95	2690.17	4491.02	3435.49	3305.72
	(478.22)***	(1838.09)***	(345.47)***	(1685.24)***	(100.06)***	(102.33)***
Observations	521	309	480	293	521	428
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.						

7.2.5 Conclusion for Search Costs

Estimating the reduced specification that only included the variables with significant parameter estimates from the full specification results in a similar result pattern as the full specification (results are shown in Table 35). For the GMM methods, the retention rate is slightly higher and while the $\hat{\beta}_4$ increased, the $\hat{\beta}_7$ decreased in magnitude.

The above analysis supports the hypothesis that search costs are a source of contribution rate setting power. There is no compelling indication that rate changes (in either direction) have a systematic impact on the member's search likelihood to search or a searchers likelihood to find a fund. The only interaction with the *ARRI*-share-market size variable that yield consistently significant parameter estimates is the lagged market share, which indicates that larger funds are more likely in a searcher's aware set. There is little evidence that the *ARRI* has a non-linear impact on demand, which would indicate that the average search effort yields relatively comprehensive information. There is only limited indication of endogeneity in the contribution rates. Autocorrelation and heteroskedasticity exist and are corrected for, but the dynamic panel bias proves to be relatively small.

Of the three variables that have a significant impact on fund membership only the impact on lagged membership is easy to interpret: On average slightly more than 5% of a fund's members search annually. The other two variables are highly constructed and thus too many

assumptions have to be made to compute an average effect. However, at the maximum (average) value that these variables take the additional membership is 18,254 (2,120) for the ARRI-membership interaction and 292,998 (5,461) for the ARRI-membership-lagged market-share variable.[161]

7.3 Switching Costs as the Single Source of Contribution Rate Setting Power

If switching costs are the single source of contribution rate setting power, switching takes place whenever the expected financial gain from switching to a lower rate fund exceed the monetary and non-monetary costs of switching. As discussed in greater detail in Chapter 5.2, switching costs likely differ across the destination funds and the insured, are on average declining over time and homogenous across funds of origin. Also, the ranking of funds by switching costs does not have to be the same across individuals and/or across time. Therefore not all switchers are necessarily joining the lowest rate fund in a market. Theoretically all funds that offer a lower contribution rate than a switcher's current fund are potential switching destinations, but the contribution rate and the likelihood of being chosen should be negatively correlated.[162]

Initially (in 1997), the flow of members should be determined by the contribution rate differences between funds. In all subsequent years, however, the change in the difference of the contribution rates should also determine switching. A constant contribution rate difference can only induce additional switching if the switching costs change, while changes in the contribution rate difference can induce additional switching even if the switching costs remain constant.

[161] Using the parameter estimates of the reduced specification GMM-IV method.
[162] Assuming no negative correlation between the fund-of-destination specific switching cost and the contribution rate, for which there would be no apparent reason.

Since under the assumption of switching costs as the lone source of rate setting power a member's preference towards his current fund does not depend on the size of the fund, any potential loss of members should be proportional to the fund's size. Thus, if the dependent variable is total membership, two differently sized but otherwise equal funds should retain (or lose) the same percentage of their current members. This percentage should depend on the fund's contribution rate in relation to the rates of all other funds. Likewise, the gain of members should depend on the market size from which a fund can draw new members, which is the share of the residual market that charges a higher rate than the fund in question, and similarly on the fund's contribution rate relative to the one of its competitors.[163]

In the years after 1997, to the degree that the average switching costs are declining and that a fund is entering new markets the absolute difference matters. Otherwise only changes in the difference of the contribution rate should determine the inflow of new members in later years. Therefore the membership for a fund *j* in period *t* can be modeled as

$$M_{jt} = \beta_1 RCR^A_{jt} M_{jt-1} + \beta_2 \Delta RCR^A_{jt} M_{jt-1} + \beta_3 RCR^B_{jt} M_{jt-1} + \beta_4 M_{jt-1} + \beta_5 RCR^C_{jt} PTHM_{jt} + \beta_6 \Delta RCR^C_{jt} PTHM_{jt} + \beta_7 RCR^D_{jt} NTHM_{jt} + \varepsilon_{jt} \quad (36)$$

RCR indicates a contribution rate measure that takes the own and competitor's contribution rate and the number of competitors into account. There are four different types of this measure, denoted by superscripts *A* to *D,* which are explained in detail in the following. The variable *PTHM* measure the size of the markets that pays a higher rate than fund *j* in period *t* and *NTHM* is the corresponding size of any newly entered market.

[163] Note that in the search costs case the searchers could be retained and thus the inflow of members depended on the share of the residual market that pays a higher rate plus the own size, while here only the share of the residual market that pays a higher rate matters.

7.3.1 Construction of the Explanatory Variables

The first four parameters measure retention (or loss) components of current members. The parameter β_1 can be interpreted as the share of last year members that switch due to the difference in relative contribution rates to funds that have been competing with the fund in question in the previous period as well. Since no fund was open before January 1996, all funds that are open in a market in January 1997 are assumed to be repeat competitors. Thus with time-invariant switching costs this parameter should be different from zero (and is expected to be negative) only in 1997. The degree to which switching costs are time variant, the parameter could be different from zero in the following years as well.[164] Two types of RCR^A are computed[165], the difference of the fund's rate to the average of its lowest rate competitor in all open markets and one more inclusive type. The more inclusive measure should simultaneously measure the contribution rate difference to the lower rate competitors as well as their number, because the larger the number of lower rate competitors is the greater the chance that one of them has a sufficiently low fund-of-destination specific switching rate to induce switching. It is, however, unlikely that the likelihood of switching increases proportionally to the number of potential destination. More likely is a less than proportional increase. The first type (RCR^A) is computed as

$$RCR_j^{A1} = \frac{\sum_{n=1}^{N} I_{jn}\left(CR_j - CR_n^{low}\right)TM_n}{\sum_{n=1}^{N} I_{jn}TM_n} = CR_j - \frac{\sum_{n=1}^{N} I_{jn}CR_n^{low}TM_n}{\sum_{n=1}^{N} I_{jn}TM_n} \qquad (37)$$

[164] Even though in 1996 all competitors are "new", in 1996 all open competitors are treated as old competitors.
[165] Without further mentioning it is understood that the market size weighted average is taken across all open markets is taken for each used RCR.

with CR_n^{low} denoting the lowest rate fund in market *n*. The total size of each individual market (TM_n) serves as weight when averaging the differences across open markets. Let k_n= *1,2,3,…, m_n, j_n, … K_n* be all funds that are open in market *n* in the previous period ordered by contribution rate in ascending order. Then m_n is the number of continuous competitors that charges a contribution rate that is lower than fund *j's*. RCR_j^{A2} is computed as

$$RCR_j^{A2} = \frac{\sum_{n=1}^{N}\left(I_{jn} TM_n \frac{\sum_{i_n=1}^{m_{jn}} \left(CR_j - CR_{in}\right)}{m_{jn}} f\left(m_n\right) \right)}{\sum_{n=1}^{N} I_{jn} TM_n} \tag{38}$$

The fraction with the inner summation sign as the numerator is the average difference between fund *j*'s and its lower rate competitors' contribution rate in each of the 17 markets. The function $f(m_n)$ represents the impact factor of the number of competitors with lower rates. Three different functional forms for $f(m_n)$ are computed: $f(m_n) = m_n$ (proportional impact), $f(m_n) = m_n^{0.5}$ (less than proportional impact) and $f(m_n) = 1$ (no impact).

The parameter $\boldsymbol{\beta_2}$ should be non-zero and negative only in the years following 1997 and is expected to be negative, because it measures the membership loss that is due to changes in the relative contribution rate. The ΔRCR_j^A can also be constructed as the change in relation to the lowest rate fund or the same measure used in the construction of RCR_j^{A2}. Thus

$$\Delta RCR_j^{A1} = \frac{\sum_{n=1}^{N} I_{jn} \Delta\left(CR_j - CR_n^{low}\right) TM_n}{\sum_{n=1}^{N} I_{jn} TM_n} = \Delta CR_j - \frac{\sum_{n=1}^{N} I_{jn} \Delta CR_n^{low} TM_n}{\sum_{n=1}^{N} I_{jn} TM_n} \tag{39}$$

or in relation to the lower rate competitors' average contribution rate change

$$\Delta RCR_j^{A2} = \frac{\sum_{n=1}^{N}\left(I_{jn} TM_n \frac{\sum_{i_n=1}^{m_{jn}} \Delta\left(CR_j - CR_{in}\right)}{m_{jn}} f\left(m_n\right)\right)}{\sum_{n=1}^{N} I_{jn} TM_n} \tag{40}$$

The parameter $\boldsymbol{\beta_3}$ can be interpreted as the effect of new competitors on the loss of members and is expected to be negative. For the first year of a new competitors' entry only the difference between the incumbent funds and the new entrant's contribution rate should determine the degree of switching. In the following year the entrant becomes an incumbent and the relationship between the two funds falls into the realm of β_2. For the first year (1997) the effect of new competitors is captured in β_2. The RCR_j^B is computed in the same fashion as RCR_j^{A2}

$$RCR_j^B = \frac{\sum_{n=1}^{N}\left(I_{jn} TM_n \frac{\sum_{i_n=1}^{m_{jn}^{new}} \left(CR_j - CR_{in}^{new}\right)}{m_{jn}^{new}} f\left(m_n^{new}\right)\right)}{\sum_{n=1}^{N} I_{jn} TM_n} \tag{41}$$

Here m_{jn}^{new} is the number of new competitors in market n that charge a lower contribution rate than fund j and CR_{in}^{new} is the contribution rate of these funds.

The parameter $\boldsymbol{\beta_4}$ picks up any effects that the size of the fund has, which could be for example lower fund-of destination switching costs for larger funds. If the size of the fund itself does not matter in determining the chance of that fund being chosen, β_4 should be equal to one.

Larger β_4 indicate that the size and fund-of-destination specific switching costs are negatively correlated. Smaller coefficients would have no clear interpretation.[166]

The remaining three parameters measure the degree to which a fund can attract switchers. The parameter $\boldsymbol{\beta_5}$ corresponds to β_1 in the sense that it is a measures for the distribution of the switchers that switch because of contribution rate differences in the first period and, as discussed above, those switchers in later years that switch due to time-variant switching costs. It includes only markets for which fund *j* did not become open in that period. By construction of the variables, β_5 is expected to be positive. The magnitude of the switching depends on the size of the market that charges a higher contribution rate than fund *j* ($PTHM_j$) and the relative contribution rate (RCR^C). $PTHM_j$ is computed almost the same way as the market that charges a higher rate in the previous chapter for search costs. The only difference is that the own fund size is not included here.[167] The likelihood of someone (who is paying a higher contribution rate and who is legally entitled to do so) to switch to fund *j* depends on two things. First the switching costs must be lower than the savings from switching and second fund *j* must be the best choice among all potential switching destinations. Therefore two separate $RCR^C s$ are computed that can be merged to one variable as well. RCR_j^{Chigh} relates the fund to those funds that charge a higher rate. Let $l_n = 1,2,3,\ldots, j_n, \ldots K_n$ be all funds that are open in market *n*, ordered by contribution rate in ascending order. Then $K_n - j_n$ is the number of competitors that charges a contribution rate that is higher than fund *j's*. With G_{jn} denoting an indicator variable that takes the value 1 if fund *j* is newly open in market *n* and 0 otherwise, RCR_j^{Chigh} is computed as

[166] They could, however, indicate a general decline in total market size - just as a parameter larger than one could indicate an increase in total market size.

[167] The reason for the exclusion is that in the search cost case the competitors and the own members are potentially searching before coming to the conclusion that this fund is the lowest rate alternative. Here where everyone is fully informed about all alternatives those who switch don't remain in their current fund by definition of switching.

$$RCR_j^{Chigh} = \frac{\sum_{n=1}^{N}\left(I_{jn}\left(1-G_{jn}\right)TM_n \frac{\sum_{i_n=j_n}^{K_n}\left(CR_{in}-CR_j\right)}{\left(K_n-j_n\right)} f\left(K_n-j_n\right)\right)}{\sum_{n=1}^{N} I_{jn}\left(1-G_{jn}\right)TM_n} \quad (42)$$

The function $f(K_n\text{-}j_n)$ again defines the relative importance of the number of competitors. The comparison with the lower rate competitors for the switchers (RCR_j^{Clow}) is

$$RCR_j^{Clow} = \frac{\sum_{n=1}^{N}\left(I_{jn}\left(1-G_{jn}\right)TM_n \frac{\sum_{i_n=1}^{j_n-1}\left(CR_j-CR_{in}\right)}{\left(j_n-1\right)} f\left(j_n-1\right)\right)}{\sum_{n=1}^{N} I_{jn}\left(1-G_{jn}\right)TM_n} \quad (43)$$

and the joined variable (RCR_j^{Clow}) is

$$RCR_j^{C} = \frac{RCR_j^{Chigh}}{RCR_j^{Clow} + RCR_j^{Chigh}} \quad (44)$$

which takes values between 0 (for the fund that charges the highest rate in all markets of operation) and 1 (for the fund that charges the lowest rate in all markets of operation). The advantage of this variable is that it manages to condense a lot of information into one meaningful number. The disadvantage is that at the extreme high end it does not control for the magnitude of the price advantage. Two funds that operate in different subsets of the whole market and are both offering the cheapest contribution rate in their respective market might differ with respect to the magnitude of their price leadership but both receive a value of one. However, for the majority of

funds that are not the (near) price leader this variable should offer a good indicator of their respective position in their market.

The parameter $\boldsymbol{\beta_6}$ corresponds to β_2 because it captures those who switch in the years following 1997 by reacting to the change of the contribution rate gap to a lower rate fund.[168] The ΔRCR_j^C is computed in the same fashion as RCR_j^C. Measuring the ratio of the weighted average sum of relative contribution rate changes toward the higher rate funds as a share of the changes towards all funds. Thus they are

$$\Delta RCR_j^{Chigh} = \frac{\sum_{n=1}^{N}\left(I_{jn}\left(1-G_{jn}\right)TM_n \frac{\sum_{i_n=j_n}^{K_n}\Delta\left(CR_{in}-CR_j\right)}{\left(K_n-j_n\right)} f\left(K_n-j_n\right)\right)}{\sum_{n=1}^{N} I_{jn}\left(1-G_{jn}\right)TM_n} \tag{45}$$

$$\Delta RCR_j^{Clow} = \frac{\sum_{n=1}^{N}\left(I_{jn}\left(1-G_{jn}\right)TM_n \frac{\sum_{i_n=1}^{j_n-1}\Delta\left(CR_j-CR_{in}\right)}{\left(j_n-1\right)} f\left(j_n-1\right)\right)}{\sum_{n=1}^{N} I_{jn}\left(1-G_{jn}\right)TM_n} \tag{46}$$

Computing a joint variable in the above fashion does not make sense, because either component could be negative or positive and the above ratio could take values close to positive or negative infinity of the sum of the two variables is close to 0.

The parameter $\boldsymbol{\beta_7}$ which is also expected to be positive, measures the amount of switchers that a fund is able to attract in the first year of entering a new market and thus depends on the contribution rate difference to the higher rate funds in the newly entered market (RCR^D) and the

[168] This can also happen if the contribution rate gap narrows if the switching cost decline faster than the gap. The only binding condition is that the fund of destination keeps charging a lower rate.

size of the newly entered market that charges a higher contribution rate than fund j ($NTHM_j$) which is computed in accordance with $PTHM_j$. RCR_j^D can be computed as

$$RCR_j^{Dhigh} = \frac{\sum_{n=1}^{N}\left(G_{jn}TM_n \frac{\sum_{i_n=j_n}^{K_n}\left(CR_{in} - CR_j\right)}{\left(K_n - j_n\right)} f\left(K_n - j_n\right)\right)}{\sum_{n=1}^{N} G_{jn}TM_n}, \tag{47}$$

$$RCR_j^{Dlow} = \frac{\sum_{n=1}^{N}\left(I_{jn}G_{jn}TM_n \frac{\sum_{i_n=1}^{j_n-1}\left(CR_j - CR_{in}\right)}{\left(j_n - 1\right)} f\left(j_n - 1\right)\right)}{\sum_{n=1}^{N} I_{jn}G_{jn}TM_n} \tag{48}$$

and

$$RCR_j^D = \frac{RCR_j^{Dhigh}}{RCR_j^{Dlow} + RCR_j^{Dhigh}} \tag{49}$$

Table 36 shows the summary statistics for the constructed *RCR* variables. Note that the last four variables are already interacted with the applicable market size variables, because they are computed separately for the old and new states before being merged.

Table 36: Switching Costs – Summary Statistics for RCR Variables

Variable	Observations	Mean	Std. Dev.	Min	Max
RCRA - lowest old competitors (1)	1360	1.714	0.932	0	4.910
Change RCRA - lowest old competitors)(2)	919	-0.044	0.569	-2.633	2.912
RCRA - avg. - proportional competitor weight (1)	1360	30.822	34.009	0	197.300
RCRA - avg. – square root competitor weight (1)	1360	4.486	3.775	0	20.537
RCRA - avg. - no competitor weight (1)	1360	0.734	0.418	0	2.423
Change RCRA - avg. - proportional competitor weight (2)	1063	3.901	16.855	-73.890	233.707
Change RCRA - avg. - square root competitor weight (2)	1063	0.623	2.370	-7.864	24.350
Change RCRA - avg. - no competitor weight (2)	1063	0.118	0.452	-1.653	3.100
RCRB - avg. - proportional competitor weight (3)	1360	5.448	6.157	0	37.520
RCRB - avg. – square root competitor weight (3)	1360	1.844	1.791	0	10.675
RCRB - avg. - no competitor weight (3)	1360	0.670	0.549	0	3.058
RCRC * higher rate market (old markets) (5)	1541	4,742,769	6,271,907	0	28,400,000
Change RCRC * lower rate market (old markets) (6)	1062	1,056,117	5,389,509	-43,600,000	47,300,000
Change RCRC * higher rate market (old markets) (6)	1062	1,261,983	5,516,283	-37,900,000	51,700,000
RCRD * higher rate market (new markets) (7)	1541	884,595.3	3,248,508	0	23,300,000

7.3.2 Estimation of the Switching Costs model

Because the structure of the model is identical, the same methods are used here as for the search costs case. By construction $\hat{\beta}_1$, $\hat{\beta}_2$ and $\hat{\beta}_3$ are expected to be negative, $\hat{\beta}_5$, $\hat{\beta}_6$ and $\hat{\beta}_7$ are expected to be positive and $\hat{\beta}_4$ should be close to 1.

First, membership for the pooled sample as well as the individual years is estimated using robust OLS. The results for using all variations of the *RCR*-variables jointly is shown in Table 37. Collinearity between the different variations of each *RCR* causes many of the parameter estimates in the first column to have an unexpected sign and to be not significant. Using the change in membership instead of the lagged membership yields high R^2 above 0.81 in all samples and usually well above 0.90.

Table 37: Switching Costs – OLS – all RCR Variations and Samples

Year	Pooled	1997	1998	1999	2000	2001	2002
B1 - RCRA - Lowest * Lagged AKV (old competitors)	-27.55	503.28	-75.63	25.30	-66.16	212.11	51.25
	(22.57)	(173.52)***	(40.87)*	(42.53)	(201.46)	(47.49)***	(18.83)***
B1 - RCRA - Avg. - Proportional * Lagged AKV (old competitors)	5.34	100.28	-12.19	29.93	-41.30	40.86	-1.08
	(1.5)***	(17.31)***	(19.06)	(24.51)	(29.78)	(8.90)***	(6.38)
B1 - RCRA - Avg. - Square Root * Lagged AKV (old competitors)	-85.36	-1231.12	179.01	-358.31	644.75	-707.10	15.45
	(24.4)***	(217.49)***	(255.13)	(298.00)	(465.6)	(152.62)***	(114.27)
B1 - RCRA - Avg. - No Funds * Lagged AKV (old competitors)	238.95	3374.48	-814.41	758.82	-2606.52	2470.96	-61.05
	(93.73)**	(613.55)***	(835.16)	(895.46)	(1923.83)	(602.97)***	(470.06)
B2 - Change RCRA - Lowest * Lagged AKV (old competitors)	33.64	-293.22	22.38	-127.24	-41.18	-117.26	-96.82
	(7.31)***	(132.01)**	(31.18)	(99.04)	(87.95)	(38.63)***	(37.26)***
B2 - Change RCRA - Avg. - Proportional * Lagged AKV (old competitors)	2.09	-98.94	-108.28	15.16	-108.47	-10.72	3.26
	(3.21)	(47.54)**	(101.03)	(22.06)	(146.39)	(9.37)	(15.17)
B2 - Change RCRA - Avg. - Square Root * Lagged AKV (old competitors)	-17.26	975.7	1212.15	-204.51	1343.59	187.6	-62.17
	(45.58)	(443.20)**	(1167.71)	(276.48)	(1873.05)	(127.91)	(202.53)
B2 - Change RCRA - Avg. - No Funds * Lagged AKV (old competitors)	12.37	-2013.69	-3356.33	799.43	-4038.26	-764.63	426.34
	(160.01)	(1085.31)*	(3328.35)	(840.25)	(5886.18)	(454.68)*	(611.63)
B3 - RCRB - Avg. - prop * Lagged AKV (new competitors)	5.29	-245.62	30.40	-67.23	19.17	-15.37	-7.10
	(9.07)	(30.72)***	(17.22)*	(28.76)**	(59.92)	(21.74)	(12.42)
B3 - RCRB - Avg. - Square Root * Lagged AKV (new competitors)	-36.93	1813.13	-220.55	346.92	-118.50	87.98	55.49
	(58.56)	(217.37)***	(107.51)**	(212.11)	(550.66)	(123.33)	(75.68)
B3 - RCRB - Avg. – No Funds * Lagged AKV (new competitors)	70.18	-3577.83	516.93	-336.97	210.61	69.45	-159.91
	(85.45)	(483.54)***	(190.9)***	(298.72)	(1282.95)	(173.48)	(136.9)
B4 – Lagged AKV	113.63	9.80	121.50	117.47	120.75	91.76	100.04
	(2.42)***	(32.54)	(3.84)***	(2.22)***	(34.73)***	(4.18)***	(2.75)***
B5 - RCRC * Higher Rate Market (old markets)	0.433	-2.66	0.177	0.021	0.541	1.40	-0.0960
	(0.133)***	(1.94)	(0.0940)*	(0.152)	(0.330)	(0.466)***	(0.259)
B6 - Change RCRC * Higher Rate Market (old markets)	-0.589	4.87	0.370	2.16	-0.612	-2.61	0.201
	(0.298)**	(3.55)	(0.362)	(0.954)**	(1.69)	(0.98)***	(0.374)
B6 - Change RCRC * Lower Rate Market (old markets)	-0.556	4.74	0.190	1.40	-0.140	-2.92	0.223
	(0.33)*	(3.5)	(0.307)	(1.17)	(1.63)	(1.01)***	(0.388)
B7 - RCRD * Higher Rate Market (new markets)	-0.253	dropped	0.268	dropped	-1.29	-1.47	0.00788
	(0.311)		(0.0649)***		(0.859)	(0.601)**	(0.309)
Observations	437	38	58	74	82	94	91
R-squared	1.000	1.000	1.000	1.000	1.000	1.000	1.000
R-squared (Change in Membership)	0.818	0.979	0.987	0.971	0.866	0.913	0.918
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.							

In Table 38 the results are shown if only the lowest rate competitor's contribution rate is relevant.[169] The estimated parameter on the contribution rate difference to the lowest rate fund displays the expected sign and is highly significant in all years. Somewhat surprisingly the effect of the change of the contribution rate difference to the lowest rate fund appears to be positive in

[169] Due to a lack of observations this variable is not computed for the market entrance of new price leaders and the one with proportional impact of the number of competitors is used.

all but one year and significant only in two other years, one of which is 1997 for which the change in differences should not have any impact. The contribution rate difference to new competitors with a lower rate appears to have no consistent influence. The estimated parameter on lagged membership is above 100% in all samples and highly significant. Due to the positive dynamic panel bias, a discussion of this parameter should be postponed until after autocorrelation is accounted for.

Table 38: Switching Costs – OLS – Lowest Rate Competitor and all Samples

Year	Pooled	1997	1998	1999	2000	2001	2002
B1- RCRA - Lowest * Lagged AKV (old competitors)	-47.83	-91.85	-52.36	-52.60	-134.00	-68.62	-32.37
	(20.99)**	(16.05)***	(15.49)***	(11.10)***	(33.61)***	(40.09)*	(23.26)
B2 - Change RCRA - Lowest * Lagged AKV (old competitors)	0.846	47.74	5.10	-19.77	25.95	63.71	22.64
	(7.73)	(19.02)**	(6.68)	(25.60)	(28.84)	(21.78)***	(14.76)
B3 - RCRB – Avg. - prop * Lagged AKV (new competitors)	-0.188	-2.06	0.876	-3.22	2.42	1.34	0.123
	(1.27)	(1.91)	(2.03)	(0.733)***	(1.25)*	(3.18)	(2.86)
B4 - Lagged AKV	109.55	129.64	108.44	114.47	125.71	112.7	107.49
	(4.02)***	(3.80)***	(2.66)***	(2.38)***	(8.22)***	(6.29)***	(2.24)***
B5 - RCRC * Higher Rate Market (old markets)	0.629	-1.10	0.163	0.0267	0.355	2.62	-0.262
	(0.205)***	(2.10)	(0.136)	(0.161)	(0.282)	(1.22)**	(0.257)
B6 - Change RCRC * Higher Rate Market (old markets)	-0.745	2.70	0.451	3.46	-0.646	-5.28	0.544
	(0.484)	(3.93)	(0.507)	(1.13)***	(1.51)	(2.54)**	(0.353)
B6 - Change RCRC * Lower Rate Market (old markets)	-0.649	2.85	0.344	2.93	-0.371	-5.00	0.429
	(0.525)	(3.95)	(0.467)	(1.39)**	(1.48)	(2.57)*	(0.332)
B7 - RCRD * Higher Rate Market (new markets)	-0.523	dropped	0.308	dropped	-0.776	-2.88	0.0297
	(0.42)		(0.0559)***		(0.599)	(1.54)*	(0.129)
Observations	437	38	58	74	82	94	91
R-squared	0.999	1.000	1.000	1.000	0.999	1.000	1.000
R-squared (Change in Membership)	0.614	0.842	0.947	0.893	0.821	0.700	0.699
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.							

The parameters estimates on the last four variables that are all indicating how the funds are gaining members are showing an inconsistent pattern of signs and significance. It is possible that they are poorly specified and thus the estimated coefficient on lagged membership is above 100% to capture the average gross gain of members. The two variables relating to $\hat{\beta}_6$ are negatively correlated (correlation coefficient = -0.826), but excluding one or the other did not

yield significant and expected parameter coefficients. The fit of the model is remarkably good with the R^2 above 0.61 for all samples.

When the weight of the number of competitors is assumed proportional and thus $f(m) = m$, the first two explanatory variables change compared to the above specification. The "contribution rate difference to lower rate competitors" variable still has a consistently negative, but now less significant impact on fund membership (see Table 39). Again the change in the contribution rate difference yields ambiguous parameter estimates and so do all other explanatory variables except for lagged membership, which is again indicating a lagged effect of over 100%, but smaller in magnitude than in the specification above. The R^2 remains high, but is also smaller than in the above specification.

Table 39: Switching Costs – OLS – Proportional Impact of Number of Competitors

Year	Pooled	1997	1998	1999	2000	2001	2002
B1 - RCRA – Avg. - Proportional * Lagged AKV (old competitors)	-0.267	-3.48	-1.13	-2.08	-3.41	-0.913	-0.337
	(0.165)	(1.49)**	(0.562)**	(0.406)***	(0.684)***	(0.633)	(0.158)**
B2 - Change RCRA - avg. - Proportional * Lagged AKV (old competitors)	0.33	1.08	0.117	-1.32	0.202	1.50	0.453
	(0.379)	(0.986)	(0.298)	(0.460)***	(0.560)	(0.343)***	(0.179)**
B3 - RCRB – Avg. - prop * Lagged AKV (new competitors)	-2.10	0.609	1.88	1.08	5.86	0.882	-0.24
	(0.891)**	(3.96)	(2.69)	(1.44)	(1.15)***	(4.22)	(1.95)
Lagged AKV (4)	102.00	106.72	100.45	108.04	110.59	103.49	103.29
	(1.77)***	(4.01)***	(2.02)***	(1.12)***	(3.35)***	(1.41)***	(1.10)***
B4 - Lagged AKV	0.594	-0.187	0.0674	0.0593	0.326	2.62	-0.145
	(0.179)***	(0.738)	(0.139)	(0.146)	(0.245)	(1.31)**	(0.206)
B5 - RCRC * Higher Rate Market (old markets)	-0.581	1.18	0.774	3.18	-0.639	-5.21	0.391
	(0.457)	(1.69)	(0.512)	(1.11)***	(1.47)	(2.7)*	(0.287)
B6 - Change RCRC * Higher Rate Market (old markets)	-0.346	1.37	0.69	2.26	-0.475	-5.05	0.293
	(0.448)	(1.73)	(0.481)	(1.25)*	(1.4)	(2.76)*	(0.257)
B6 - Change RCRC * Lower Rate Market (old markets)	-0.161	0.256	0.223	0.112	-0.157	-0.362	-0.0339
	(0.122)	(0.359)	(0.215)	(0.121)	(0.147)	(0.399)	(0.0452)
Observations	517	54	69	86	103	104	101
R-squared	0.999	1.000	1.000	1.000	0.999	1.000	1.000
R-squared (Change in Membership)	0.540	0.787	0.913	0.921	0.838	0.737	0.696
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.							

The pattern of the results found if a less than proportional impact of the number of funds ($f(m) = m^{1/2}$, results in Table 40) or if no impact of the number of funds ($f(m) = 1$, results in Table 41) is assumed for the variables associated with $\hat{\beta}_1$, $\hat{\beta}_2$ and $\hat{\beta}_3$ is very similar to those found with proportional impact.

These preliminary results suggest that switching costs appear to be fairly homogenous across funds of destination, because the lowest rate fund's price appears to have a stronger effect on membership than some weighted average of all lower rate competitors. This would also explain why the chosen variables for the gain of switchers appear weak as they are all a measure of the fund's relative position to all funds.

Table 40: Switching Costs – OLS – Less than Proportional Impact of Number of Competitors

Year	Pooled	1997	1998	1999	2000	2001	2002
B1 - RCRA – Avg. - Square Root * Lagged AKV (old competitors)	-3.92	-3.18	-10.98	-15.69	-30.08	-4.35	-3.52
	(2.03)*	(13.96)	(6.05)*	(3.63)***	(5.95)***	(8.34)	(2.89)
B2 - Change RCRA - avg. - Square Root * Lagged AKV (old competitors)	2.05	9.09	1.19	-8.18	-0.568	12.02	4.06
	(2.46)	(5.12)*	(1.51)	(2.76)***	(4.59)	(2.38)***	(1.47)***
B3 - RCRB – Avg. - Square Root * Lagged AKV (new competitors)	-7.92	-27.92	2.86	1.09	23.00	-9.94	-2.20
	(3.14)**	(20.16)	(13.72)	(6.00)	(6.54)***	(21.72)	(8.87)
B4 - Lagged AKV	103.78	113.69	104.41	109.74	112.86	103.6	104.31
	(2.21)***	(3.74)***	(2.24)***	(1.29)***	(3.71)***	(2.01)***	(1.13)***
B5 - RCRC * Higher Rate Market (old markets)	0.545	-0.123	0.125	0.0456	0.324	2.63	-0.254
	(0.189)***	(0.687)	(0.121)	(0.146)	(0.241)	(1.29)**	(0.233)
B6 - Change RCRC * Higher Rate Market (old markets)	-0.508	0.885	0.517	3.32	-0.602	-5.28	0.512
	(0.476)	(1.61)	(0.443)	(1.07)***	(1.48)	(2.68)**	(0.325)
B6 - Change RCRC * Lower Rate Market (old markets)	-0.314	1.04	0.426	2.47	-0.513	-5.06	0.433
	(0.48)	(1.66)	(0.408)	(1.21)**	(1.38)	(2.74)*	(0.302)
B7 - RCRD * Higher Rate Market (new markets)	-0.150	0.114	0.0859	0.117	-0.156	-0.366	-0.0219
	(0.117)	(0.312)	(0.256)	(0.119)	(0.145)	(0.401)	(0.0347)
Observations	517	54	69	86	103	104	101
R-squared	0.999	1.000	1.000	1.000	0.999	1.000	1.000
R-squared (Change in Membership)	0.579	0.829	0.935	0.928	0.840	0.747	0.725
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.							

Table 41: Switching Costs – OLS – Less than Proportional Impact of Number of Competitors and all Samples

Year	ALL	1997	1998	1999	2000	2001	2002
B1 - RCRA – Avg. - No Funds * Lagged AKV (old competitors)	-85.81	111.08	-112.51	-125.00	-237.31	23.39	-41.51
	(22.39)***	(70.56)	(38)***	(40.17)***	(59.29)***	(46.60)	(71.32)
B2 - Change RCRA - avg. - No Funds * Lagged AKV (old competitors)	13.53	75.2	6.37	-64.65	-12.94	96.53	36.21
	(12.64)	(26.23)***	(4.75)	(23.00)***	(39.98)	(18.94)***	(10.67)***
B3 - RCRB – Avg. - No Funds * Lagged AKV (new competitors)	-2.17	-210.82	22.44	9.82	65.05	-99.38	-8.55
	(17.70)	(55.96)***	(38.27)	(32.55)	(48.57)	(36.59)***	(50.48)
B4 - Lagged AKV	107.14	116.67	107.82	110.79	115.26	102.84	105.67
	(2.36)***	(1.81)***	(1.97)***	(1.95)***	(4.38)***	(1.91)***	(0.384)***
B5 - RCRC * Higher Rate Market (old markets)	0.540	-0.395	0.124	0.0260	0.348	2.70	-0.397
	(0.188)***	(0.666)	(0.118)	(0.156)	(0.242)	(1.28)**	(0.271)
B6 - Change RCRC * Higher Rate Market (old markets)	-0.604	1.39	0.518	3.88	-0.693	-5.45	0.675
	(0.464)	(1.56)	(0.427)	(1.09)***	(1.51)	(2.66)**	(0.383)*
B6 - Change RCRC * Lower Rate Market (old markets)	-0.478	1.49	0.422	3.20	-0.598	-5.16	0.621
	(0.481)	(1.62)	(0.393)	(1.24)**	(1.37)	(2.71)*	(0.372)*
B7 - RCRD * Higher Rate Market (new markets)	-0.151	0.0977	0.0469	0.145	-0.149	-0.377	-0.00656
	(0.114)	(0.311)	(0.256)	(0.143)	(0.144)	(0.409)	(0.0293)
Observations	517	54	69	86	103	104	101
R-squared	0.999	1.000	1.000	1.000	0.999	1.000	1.000
R-squared (Change in Membership)	0.662	0.890	0.963	0.917	0.836	0.761	0.760
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.							

7.3.3 Endogeneity and Autocorrelation

Because the *RCRs* that relate to the lowest rate competitors appear to be superior predictors of fund membership, they are chosen as explanatory variables for the dynamic panel analysis and the entire set of available instruments is used to control for endogeneity.

The results for the robust OLS, FE and one-step system GMM methods for the full specification are reported in Table 42. The Hausman test for endogeneity strongly indicates endogeneity for both the robust OLS and the fixed effects approach. For the one-step system GMM the Hausman test fails to produce a test statistic. The Arellano-Bond test rejects the null of no first order autocorrelation ($z = -3.87$) and fails to reject the null of no second order

autocorrelation (z = 1.43) if the outside instruments are excluded.[170] If these instruments are included the test results are the opposite. The instruments show the same type of weakness as in the search costs case.

For both fixed effects methods the parameter estimate for lagged membership is below 100%.[171] As explained above, the fixed effects method usually results in downward biased estimates on lagged explanatory variables. The FE-IV method is the only one with a positive price effect and both fixed effects method yield insignificant $\hat{\beta}_1$. The estimated parameters on $\hat{\beta}_5$, are the only ones of the last four rows that are significant for more than half the methods and that always display the expected sign. Thus in the reduced specification the last three variables are dropped and so are the ones associated with $\hat{\beta}_2$ and $\hat{\beta}_3$.

Table 42: Full Specification – Different Panel Methods

Method	OLS	IV	FE	FE-IV	BB	BB-IV
B1 - RCRA - Lowest * Lagged AKV (old competitors)	-47.83	-96.99	-18.59	36.08	-48.90	-35.31
	(21.12)**	(21.23)***	(11.90)	(43.04)	(3.21)***	(3.23)***
B2 - Change RCRA - Lowest * Lagged AKV (old competitors)	0.846	18.38	-10.92	-43.37	1.47	-5.39
	(8.11)	(22.52)	(7.43)	(25.12)*	(1.49)	(1.49)***
B3 - RCRB – Avg. - prop * Lagged AKV (new competitors)	-0.188	2.26	-0.822	-1.03	-0.131	-0.446
	(1.23)	(2.13)	(1.18)	(3.15)	(0.213)	(0.214)**
B4 - Lagged AKV	109.55	118.31	97.19	52.67	109.73	106.52
	(4.06)***	(3.66)***	(11.37)***	(23.53)**	(0.621)***	(0.687)***
B5 - RCRC * Higher Rate Market (old markets)	0.629	0.299	0.868	1.23	0.736	0.861
	(0.215)***	(0.896)	(0.478)*	(1.99)	(0.129)***	(0.190)***
B6 - Change RCRC * Higher Rate Market (old markets)	-0.745	0.219	-0.532	0.0571	-0.908	-1.33
	(0.469)	(1.94)	(0.476)	(2.72)	(0.286)***	(0.411)***
B6 - Change RCRC * Lower Rate Market (old markets)	-0.649	0.946	-0.679	-0.052	-0.856	-1.39
	(0.503)	(2.01)	(0.482)	(2.26)	(0.294)***	(0.412)***
B7 - RCRD * Higher Rate Market (new markets)	-0.523	25.77	-1.51	-5.63	-0.452	-0.118
	(0.428)	(22.88)	(0.553)***	(6.01)	(1.24)	(2.71)
Observations	437	265	404	252	437	265
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.						

The sample size varies greatly across methods, but restricting the sample size to the smallest denominator does not change any of the Hausman test results and since the one-step

[170] Outside instruments are those that are not past members or contribution rates.
[171] The parameter estimates and standard errors for the lagged membership are rescaled to be comparable to the results in the earlier estimations.

system GMM without outside instruments appears to be the preferred specification the sample size is kept as large as possible.

The results for the reduced specification are found in Table 43. Overall the estimated parameters are more significant and the previous outliers for the lagged dependent variable in the fixed effects methods are more in line with the parameter estimates of the other methods. The Hausman test for endogeneity still rejects the null of no endogeneity for the robust OLS method, but now fails to reject the null for the fixed effects model and again fails to produce a test statistic for the one-step system GMM method. The tests for autocorrelation show the same rejection pattern as for the full specification.

Table 43: Reduced Specification – Different Panel Methods

Method	OLS	IV	FE	FE-IV	GMM	GMM-IV
B1 – RCRA - Lowest * Lagged AKV (old competitors)	-51.21	-68.25	-33.59	-34.28	-49.9	-43.43
	(16.35)***	(14.16)***	(13.59)**	(20.69)*	(2.02)***	(2.15)***
B4 - Lagged AKV	110.16	114.22	105.51	112.71	109.35	107.96
	(3.82)***	(3.46)***	(11.86)***	(13.08)***	(0.511)***	(0.549)***
B5 - RCRC * Higher Rate Market (old markets)	0.326	0.495	0.464	2.27	0.572	0.424
	(0.073)***	(0.166)***	(0.304)	(1.24)*	(0.0939)***	(0.102)***
Observations	521	309	480	293	521	309
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.						

7.3.4 Conclusion for Switching Costs

The results of the switching costs only approach can explain the switching dynamics in the sickness fund sector. The fact that the driving force of switching are contribution rates difference levels even after the initial year of switching defies some of the initial ideas of how the switching costs are structured. One possible explanation is that switching costs are continuously declining at a rate that allows the contribution rate differences to be the major determinant of switching. Alternatively a mixed approach of search and switching costs is possible. If a person's propensity to search is uncorrelated across time thus a pool of previous

non-searchers is searching every period, the contribution rate difference could matter if these people, once they found a lower rate alternative, face the decision of whether switching to this alternative fund is worthwhile given their individual switching costs.

The fact that the contribution rate difference to the lowest rate fund dominates the more inclusive measures superficially suggests that switching is taking place only between a fund and the lowest rate fund. However, it is possible that the alternatively tested variables are too inclusive towards middle-of-the-pack funds and a measure that is more biased towards a number of the lowest rate funds would be most appropriate.

Using the one-step system GMM parameter estimates as a reference, the $\hat{\beta}_1$ suggests that a 1 percentage point difference between a fund's contribution rate and the lowest rate fund translates into a 4.99% reduction in expected membership. Interpreting $\hat{\beta}_5$ is more complex as one has to make assumptions about market size, share of members, the average number of competitors and the sum of contribution rate differences. However, the range of the membership impact can easily be computed. The estimated maximum increase in membership is 16,229 and the minimum is 0. The 16,629 is much smaller than the maximum membership change found in the data set (281,081). Thus it might be preferable to construct an alternative measure of the price advantage that is more biased towards lower rate funds. However, some of the difference between the highest predicted and observed value is captured by the parameter estimate on the lagged membership, which is significantly larger than one. One interpretation is that the fund-of-destination specific switching costs are negatively correlated with the size of the fund. An alternative explanation is the exogenous growth of the entire market, but this is certainly not able

to explain the entire difference, because the fund membership growth in Germany was much smaller than the difference between the estimated parameter and 100%.[172]

7.4 Joint Sources of Contribution Rate Setting Power

The previous analysis has shown strong support for both switching and search costs as sources of contribution rate setting power, but no support for product heterogeneity as the only source. It cannot be ruled out, however, that non-price fund attributes have an impact on fund choice even in the presence of inertia in the market. Thus in a first step the non-rate attributes are combined separately with both switching costs and the search costs models. In a second step the search and switching costs models are combined to test whether one of the two sources has a dominating effect over the other.

7.4.1 Joint Effects of Non-Rate Attributes and Models allowing for Inertia

One major problem arises from the fact that the non-rate attributes are available only for some years and thus a dynamic panel analysis produces meaningless results. Therefore, for the four years for which the surveys were conducted, the robust OLS model of the reduced specification is estimated for both combinations: switching costs with non-rate attributes and search costs with non-rate attributed.

[172] One crucial question is how the new market members enter the market. Most of the new members are former dependents (children) of members that likely switched their membership status within their fund. Thus this effect would apply to all funds roughly proportionally (assuming symmetry of the member/children ratio) and would be included in the $\hat{\beta}_4$.

In all four years and both switching and search costs the parameter estimate of only one non-rate attribute was significantly different from zero in one year, but this one displays a negative sign suggesting that being open on Saturdays has a negative impact on fund membership (results are not shown). All other estimated parameters on the non-rate attributes are insignificant and the pattern of the displayed signs appears random.

To control for potential collinearity among the non-rate attributes a single variable for the fund's non-rate attributes is constructed for the 1998 survey. The variable is the sum of all non-rate attributes, each divided by the respective sample means to ensure that each non-rate attribute has equal weight.[173] Included in both, the robust OLS model for the reduced search costs and switching costs specifications, the parameter estimate is highly insignificant and in the search costs case even negative.

Thus it is safe to conclude that at least the observed fund specific non-rate attributes have no measurable impact on fund membership. One interesting variable that could be of particular interest, the number of branches (or the density of the branch network), is unfortunately not available.[174]

7.4.2 Switching Costs or Search Costs?

To identify whether one source dominates the other, the reduced specifications for both sources are combined and estimated jointly, using robust OLS, fixed effects and the one-step system GMM models, all three with and without instrumental variables. The reduced specification is chosen, because it includes enough meaningful variables to allow for the major

[173] The model project participation is the only non-rate attribute can take values less than zero. Since the mean value is negative this variable could not be divided by its mean and is therefore simply added without an assigned weight.
[174] This variable would be interesting to observe, because it is likely correlated with switching and potentially also with search costs.

effects of each source, but individually has sufficiently few variables to exclude most within-source collinearity. The results for the joint estimation are shown in Table 44.

Table 44: Joint Estimation – Different Panel Methods

Method	OLS	IV	FE	FE-IV	GMM	GMM-IV
B1 - Lagged Membership	1.00	1.11	0.98	0.79	1.00	1.00
	(0.0426)***	(0.103)***	(0.0966)***	(0.084)***	(0.00724)***	(0.00695)***
B2 - RCRA - Lowest * Lagged Membership (old competitors)	-16.01	-58.78	-8.03	6.85	-17.28	-15.35
	(16.24)	(32.43)*	(7.08)	(14.08)	(2.6)***	(2.5)***
B3 - RCRC * Higher Rate Market (old markets)	0.09	0.79	-0.10	-0.67	0.23	0.10
	(0.125)	(0.642)	(0.188)	(1.40)	(0.149)	(0.157)
B4 - Adjusted ARRI * Share * Total Market (in 1000)	22.09	-43.19	-12.03	-139.60	10.74	15.59
	(15.56)	(71.03)	(18.71)	(103.86)	(20.51)	(19.27)
B5 - Adjusted ARRI * Share * Total Market * Lagged Market Share	2587.73	800.19	2412.59	6079.22	2772.98	2319.75
	(647.17)***	(3093.9)	(312.52)***	(1719.66)***	(146.24)***	(145.52)***
Observations	521	309	480	293	521	309
Standard errors in parentheses. *, **, *** indicate significance at 90%, 95% and 99% confidence interval.						

The lagged membership is used by both switching and search costs. The second and third variables originate in the switching costs model and the fourth and firth in the search costs model. The parameter estimate for the second variable is expected to be negative and the last three parameter estimates are expected to be positive. The focus here is on the GMM model, because the Arellano-Bond test for first order autocorrelation (z = -3.44) rejects the null of no autocorrelation[175] and the Hausman test for endogeneity rejects endogeneity. The parameter estimate of one variable from each source is highly significant and displays the expected sign, while the other parameter estimate of either source is not.

The fact that $\hat{\beta}_1$ is estimated to be exactly 1.00 and that $\hat{\beta}_2$ is significantly negative strongly suggests that the major source of membership loss for a fund is based in the fact that there are lower rate alternatives with a contribution rate advantage. Switching costs as the major source would require the $\hat{\beta}_1$ to be less than 1 because a certain share of its members "shop

[175] But barely fails to reject the null for second order autocorrelation (z = 1.96)

around" and decide to join the lowest rate alternative or remain in their current fund. Also the fact that the most exclusive relative price variable[176] and not one that includes an indication of the number of lower rate competitors displays the most significant parameter estimate further supports the hypothesis of switching costs being the main source.

The positive and significant parameter estimate on $\hat{\beta}_5$ indicates that a larger past market share makes a fund more likely to be in a searchers' aware set. An alternative interpretation is consistent with switching costs is that average fund-of-destination specific switching costs are negatively correlated with fund size, because larger funds usually maintain a larger network of branches and are more likely to be present on-line.

[176] The difference to the lowest rate competitor includes only one fund per market

8 Conclusion

This research has found strong evidence that switching costs are the dominant source of contribution rate setting power in the German statutory sickness fund sector. While product heterogeneity can be safely ruled out as a possible source, at least as far the data used for this research includes non-rate attributes, a secondary impact of search costs cannot be ruled out altogether and is even likely.

This research provides a good answer to why people are switching and the reasons indicate that they switch because the financial gains from switching are higher than the costs of it. However, the research is not able to identify why people do not switch. For example it is not possible to precisely distinguish between someone not switching because his switching costs are too high or because of his decision to remain ignorant of his options.

Typically the estimated models failed to find any impact of secondary factors on switching that would refine the broad estimate of the main price variables. This can be caused by the relatively small sample size. The lagged market share is the lone exception here and proved to have a positive impact of membership, even in the dynamic panel approach.

Whether endogeneity is a major problem cannot be answered with certainty, because the available instruments are not very strong and thus the appropriate tests for endogeneity are to be interpreted with care. However, whenever endogeneity appeared to be a problem it was addressed and controlled for as well as the existing instruments allowed.

If a fund's objective is to maximize its size, the conclusion that can be drawn from this research is that they should devote their resources towards making it as easy as possible for any potential member to switch to that fund, rather than offering non-mandated coverage. If the policy makers want to increase switching, they need to design policies that further reduce switching costs.

As many questions as this research answers, there are many more questions that should be addressed in future research. It would be interesting to look into individual level data to identify the primary source of contribution rate setting power. The DIW in Berlin has these data, but unfortunately is it not available in the public use version of the SOEP. Using individual level data would allow looking into individual switching patterns and would help to answer many questions that aggregated data like the one used here cannot answer.

If it were possible to increase the sample size of the firm level data set, it would not only be possible to obtain more precise parameter estimates, but also to include additional variables, that are included in the data, but not thoroughly tested like the timing of contribution rate changes. Obtaining better instruments would allow a more successful treatment of potential endogeneity. Ideally more direct cost data from the individual should be used.

Finally it would be interesting to apply the presented methodology to data in different, albeit similar markets. These could be the health insurance choice in different countries and settings or even markets for different goods, in which similar questions arise.

Appendix

Appendix A: Internet and Print Sources used to create the Data Set

I) On-line sources

1) Billiger Krankenversichert (2001, 2002): http://www.billiger-krankenversichert.de/abc/bkk.shtml. Accessed at different times 2001/2002

2) BKK Bundesverband (2001, 2002): Addresses, contribution rates and regions of operation for all BKKs, www.bkk.de, updated February 2001, June 2001, August 2001, March 2002. (http://www.dr-peglow.de/Informationen/Krankenkassen/ liste_bkk.pdf for February 2001 list, http://www.bkk.de/ps/tools/download .php?file=/bkk///psfile/ downloaddatei/63/BKK_Liste_4145bd9f67e11.pdf&name=BKK_Liste%20November%202004.pdf&id=291&nodeid=291 for location of current overview).

3) Bundesministerium für Gesundheit: http://www.bmg.bund.de/cln_041/ nn_600110/ DE/Statistiken/statistiken-node,param=.html__nnn=true, last access: January 23rd, 2006.

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Appendix B: The Questionnaire

Alte Bundeslaender	1.1.1996	1.1.1997	1.1.1998	1.1.1999	1.1.2000	1.1.2001	1.1.2002
ermaessigter Beitragssatz							
normaler Beitragssatz							
Erhoehter Beitragssatz							
Seit*							
Pflichtversicherte							
davon Studenten							
davon Arbeitslose							
freiwillig Versicherte							
AKV							
Rentner							
SUMME MITGLIEDER							
Famile							
SUMME VERSICHERTE							

*Please enter if contribution rate change occurred at a date other than January 1st.

The attachment that was sent to the funds included three tables like the one above, one for each the old and new states and one for all of Germany. Also the funds were asked to list all past mergers and, if available, to file the above table for the predecessor funds as well.

Appendix C: Estimation Results

Table 45: Fixed and Random Effects – Product Differentiation – Full Specification

Dependent Variable	RAMS	RAMS	DAMS	DAMS	Membership	Membership
Model	FE	RE	FE	RE	FE	RE
Contribution Rate	-0.794	0.626	0.00746	0.01	8559.08	11110.2
	(0.456)*	(0.313)**	(0.00223)***	(0.00257)***	(5240.81)	(5381.2)**
Average competitors' contribution rate	7.64	4.35	-0.0376	-0.0428	-86505.3	-91840.6
	(2.47)***	(1.98)**	(0.0245)	(0.0242)*	(37743.5)**	(37541)**
Access on Saturdays	-0.771	0.66	-0.0539	-0.0538	-176815	-186298
	(11.62)	(11.92)	(0.0426)	(0.0567)	(147862)	(167347)
Access on Sundays	0.798	0.448	0.00584	0.00556	19151.5	19605.9
	(1.21)	(1.38)	(0.00464)	(0.0058)	(13118.5)	(14035.1)
Percentage Coverage Mother Spa Visits	-1.68	-0.427	0.00616	0.008	7652.3	10448.3
	(0.802)**	(0.777)	(0.004)	(0.00425)*	(20797.5)	(17554.4)
Web Presence	-2.44	10.28	-0.0835	-0.0519	-530124	-459456
	(34.34)	(37.84)	(0.18)	(0.215)	(694807)	(916297)
Homesick Care Entitlement	-0.72	-1.27	0.00212	0.00109	14176	13322.9
	(0.596)	(0.679)*	(0.00232)	(0.00245)	(9566.77)	(10273.4)
Homesick Care Max. Weeks	-1.32	-0.962	0.000793	0.0013	-324.32	-169.21
	(0.572)**	(0.826)	(0.00261)	(0.00336)	(10594.2)	(9806.54)
Domestic Help Entitlement w/ Children	2.46	1.48	-0.00451	-0.00583	8341.29	7934.56
	(1.03)**	(1.21)	(0.00521)	(0.00553)	(17785.3)	(34307.4)
Domestic Help Entitlement w/o Children	-0.75	-0.123	-0.000724	0.000337	-8789.79	-9420.83
	(0.736)	(0.906)	(0.0031)	(0.00371)	(9759.19)	(30856.1)
Competitors' Access on Saturdays	9.66	4.88	-0.17	-0.167	-427100	-412642
	(31.1)	(40.4)	(0.142)	(0.138)	(291143)	(282340)
Competitors' Access on Sundays	-7.7	-8.09	0.12	0.112	214912	188523
	(32.22)	(38.49)	(0.173)	(0.168)	(313075)	(297753)
Competitors' Percentage Coverage Mother Spa Visits	29.78	17.76	-0.17	-0.184	16844.9	-19689.6
	(22.15)	(16.34)	(0.138)	(0.165)	(250422)	(276575)
Competitors' Web Presence	18.35	15.96	-0.00834	-0.013	-100496	-106251
	(9.99)*	(13.42)	(0.0715)	(0.0697)	(110959)	(113952)
Competitors' Homesick Care Entitlement	0.62	5.41	-0.0471	-0.0392	-146142	-142688
	(17.65)	(18.44)	(0.083)	(0.0942)	(162399)	(185208)
Competitors' Homesick Care Max. Weeks	-0.215	-0.16	-0.00034	-0.000241	1213.12	1292.09
	(0.172)	(0.214)	(0.00137)	(0.00128)	(2114.35)	(2090.87)
Competitors' Domestic Help Entitlement w/ Children	-11.05	13.97	0.743	0.765	1030120	1069660
	(67.44)	(73.31)	(0.419)*	(0.432)*	(725763)	(740273)
Competitors' Domestic Help Entitlement w/o Children	-21.36	-36.75	-0.515	-0.528	-890465	-894066
	(50.93)	(61.91)	(0.343)	(0.316)*	(591416)	(594538)
Special Programs FT (rel. Participation Index)	-0.954	-0.715	0.00175	0.00146	597.47	794.33
	(1.57)	(1.7)	(0.00476)	(0.00522)	(21456.3)	(19794.3)
Competitors' Special Programs FT (rel. Participation Index)	23.18	25.04	0.165	0.168	322437	332383
	(42.12)	(55.88)	(0.207)	(0.21)	(460720)	(426465)
In Survey - Finanztest	0.62	0.474	0.00236	0.00267	11183.9	11255.6
	(0.92)	(1.11)	(0.00341)	(0.0031)	(11452.1)	(8767.5)
Special Programs DMEuro (rel. Participation Index)	3.17	2.83	-0.0024	-0.00184	262.44	-443.99
	(1.35)**	(1.56)*	(0.00345)	(0.00379)	(16992.7)	(16511)
Competitors' Special Programs DMEuro (rel. Participation Index)	20.66	-27.86	-0.224	-0.31	-441743	-512133
	(93.41)	(126.58)	(0.334)	(0.268)	(893804)	(561851)
In Survey - DMEuro	-1.62	-1.64	0.0024	0.00171	3342.38	3357.95
	(0.907)*	(1.01)	(0.00475)	(0.00429)	(12226.5)	(13620.3)
Special Programs BKV (rel. Participation Index)	-15.62	-3.52	-0.0655	-0.0656	-805734	-668776
	(32.27)	(43.31)	(0.157)	(0.177)	(633565)	(1862920)
Competitors' Special Programs BKV (rel. Participation Index)	-63.7	-19.11	0.109	0.189	498016	547665
	(73.18)	(91.23)	(0.259)	(0.184)	(737323)	(430912)
In Survey - BKV	0.606	0.798	-0.00527	-0.00485	-7072.06	-7121.23
	(0.624)	(0.708)	(0.00532)	(0.00414)	(10428.1)	(12296.8)
Constant	-83.68	-61.03	0.421	0.44	1219460	1211880
	(28.61)***	(24.31)**	(0.292)	(0.286)	(450284)***	(460063)***
Observations	631	631	631	631	631	631
Number of Different Funds	190	190	190	190	190	190

Table 46: Fixed and Random Effects – Product Differentiation – Only Price Effects

Dependent Variable	RAMS	RAMS	DAMS	DAMS	Membership	Membership
Model	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed effects	Random Effects
Contribution Rate	-0.62	0.358	0.00597	0.00772	6169.72	7973.87
	(0.333)*	(0.304)	(0.00167)***	(0.00167)***	(5283.5)	(5308.1)
Average competitors' contribution rate	4.17	2.87	-0.0119	-0.0141	-35596.7	-37959.7
	(0.729)***	(0.719)***	(0.00366)***	(0.00371)***	(11573.5)***	(11658.9)***
Constant	-42.06	-39.1	0.112	0.102	601533	569530
	(8.27)***	(8.38)***	(0.0415)***	(0.0428)**	(131212)***	(139137)***
Observations	647	647	647	647	647	647
Number of Different Funds	190	190	190	190	190	190

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