Is There Market Discipline in the European Insurance Industry? An Analysis of the German Insurance Market

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ABSTRACT

The financial services industry has undergone significant regulatory change in the past two decades due to Basel II (banking) and Solvency II (insurance). Even though these promulgations are focused on European institutions, their influence extends around the globe. An important dimension of this new regulatory environment is the explicit reliance on market discipline. The extent to which market discipline can be relied upon for successful regulation depends on the strength of its influence. The research reported here is intended to provide input for measuring this strength in the German insurance market. Specifically, we analyze the relationship between two measures of market discipline (premium growth and termination rates) and two market signals (changes in financial strength ratings and complaint statistics). Our results indicate that market discipline has only limited effect to date in the German insurance market. We therefore conclude that for regulators to utilize market discipline as a building block within the new regulatory framework, they will need to increase market transparency.

1. INTRODUCTION

Insurance supervision in the European Union is undergoing significant change as the European Commission works toward harmonization across member countries as well as toward the implementation of risk-based capital standards. Current efforts are focused on Solvency II regulations, which are due for implementation in 2012 (see European Commission, 2007, and Eling, Schmeiser, and Schmit, 2007, for an overview). One of the three pillars of the new Solvency II framework deals with market transparency and disclosure requirements, which aim at promoting market discipline (see Linder and Ronkainen, 2004). The expectation is that a transparent process will require less overt regulatory intervention as market participants themselves will force appropriate insurer behavior. Market discipline, i.e., the influence of customers, brokers, rating agencies, and investors

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on firm behavior, could be a substantial building block of the new Solvency II with the goal of creating a strong and solvent insurance industry.

Market discipline in the insurance industry has been studied to some extent using U.S. data; however, we do not know of any research using European data.[1] Given significant differences between the U.S. and European insurance markets, including regulatory requirements and cultural norms, any true evaluation of the potential influence of market discipline on European insurer behavior requires specific focus on the European industry. Here, we assess the scope and effectiveness of market discipline in the German insurance industry, which in terms of premiums is the second largest insurance market in the European Union (after the United Kingdom; see OECD, 2007). Specifically, we consider the effectiveness of rating agency evaluations and consumer complaints on insurer premium volume as a measure of market discipline. U.S. experience suggests that rating agencies are more successful at identifying financial distress than is the regulatory framework (see Pottier and Sommer, 2002); therefore, we anticipate a reaction to rating agency news.

Following Epermanis and Harrington (2006), we analyze the relationship between changes in ratings data and insurance premium growth. In the year of and the year following a rating downgrade, Epermanis and Harrington found economically and statistically significant premium growth change in a large sample of U.S. property-liability insurers, leading them to conclude that market discipline has a strong influence. We are interested in seeing if the same will be true for Germany, thereby providing input regarding the extent to which the market is a strong disciplining factor on insurance companies. We extend Epermanis and Harrington (2006) by considering complaint statistics as a second disciplining mechanism. German insurers often use complaint statistics in their marketing efforts, which would suggest that complaints should have some market effect. These data also represent the only source of consumer information that has been systematically collected across many years. Because the information is used as selling device by insurers and insurance agents, it may have some influence on premium growth.

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[1] Adams, Burton, and Hardwick (2003) employ U.K. data in investigating credit-rating practices; however, their research does not address market discipline itself.

We also measure the effect of changes in ratings and complaint statistics on life insurance termination rates. Zanjani (2002) finds a positive relationship between insurer default risk and policyholder termination rates; thus termination rates might be a second measure of market discipline. We further extend the work of Epermanis and Harrington (2006) by analyzing different lines of business; whereas they focus on property-liability, our analysis covers data on 130 life, 316 property-liability, 63 health, and 52 reinsurers between 1996 and 2005.

Our main findings are as follows. We observe significant premium declines following rating downgrades, but less clear reactions following rating upgrades, consistent with the Epermanis and Harrington (2006) results for the U.S. market. The premium declines, however, are smaller than in the United States, which suggests weaker market discipline in the German market compared with that country. We also observe significant premium declines in some instances following an increase in the number of complaints, but no significant results following a decrease, similar to our results for financial strength ratings. When analyzing termination rates in life insurance instead of premium growth as a market reaction, results are consistent with the findings for financial strength ratings and complaint statistics. We conclude that the downside risk of sending a bad market signal is greater than the upside potential of a good market signal, consistent with the literature on the effects of negative and positive news (see Chan, 2003; Hong, Lim, and Stein, 2000; Schmitz, 2007). Overall, the results suggest that there is some market discipline in the German insurance industry, but that regulators need to enforce the mechanisms than can strengthen it (e.g., transparency requirements), if they wish to use market discipline to create a strong and solvent insurance industry.

The remainder of the paper is organized as follows. In Section 2, we present an overview of the existing literature on market discipline, both for the field of banking and for the field of insurance. Our hypotheses, data, and methodology follow in Section 3. We present results in Section 4 and conclude in Section 5.

2. LITERATURE

Financial services organizations are highly regulated. The general justification for extensive governmental intervention is that business and society are dependent on the financial services sector for personal and business transactions and, furthermore, that these industries are subject to strong systematic risk, which could undermine the entire economy (see, e.g., Santomero, 1997). Solvency regulation, therefore, is considered of great importance. Historically, solvency

regulation focused on capital adequacy, imposing certain minimum capital requirements, either on an absolute or risk-adjusted basis. Recently, however, regulators have begun incorporating market-based elements into regulatory regimes. Most notable is Basel II's incorporation of "market discipline" among its three regulatory pillars.

Likely due in large part to Basel II, most research addressing the ability of market discipline to regulate the financial industry has focused on the banking sector (see, e.g., Flannery, 1998; Martinez et al., 2001; King, 2008). Solvency II, which covers European insurers, is due to be implemented in the fairly near future. This regulatory scheme also has three pillars, very similar to Basel II, and thus there is an increased interest in studying market discipline in the insurance context. A sometimes explicit, but usually implicit, purpose of such research is to assess conditions under which market discipline can replace overt regulatory action.

In 2000, researchers assembled for a conference on market discipline in the banking sector sponsored by the Federal Deposit Insurance Corporation (FDIC) in Washington, D.C. The proceedings, titled "Incorporating Market Information into Financial Supervision," were subsequently published in the *Journal of Financial Research*. Flannery introduced the conference with a review of the literature to date and concluded: "It seems likely that investors have a comparative advantage in monitoring, while supervisors have a comparative advantage in influencing" (2001, p. 116).

Of relevance to our research because of the focus on European data is Sironi (2003), who finds that European banks' debenture spreads reflect risk. More recently and also using European bank data, Distinguin, Rous, and Tarazi (2006) refine the results and observe that the accuracy of models in predicting bank financial distress through use of stock market information depends on the extent to which bank liabilities are tradable. Models that account for these nuances, therefore, will be more valuable.

Research focused on banks is helpful in understanding the influence of market discipline, but we would anticipate some variations in insurance sector. The literature using insurance data is not as extensive as that found in banking research, nor does it often employ non-U.S. data.

Some of the early work in insurance offers implications rather than direct tests of market discipline, having focused, instead, on the effect of insurer risk management on organizational success. Sommer (1996), Phillips, Cummins, and Allen

(1998), and Cummins and Danzon (1997) all find a negative relationship between property-casualty prices and firm risk, consistent with market discipline effects. Because low prices could cause greater risk, however, ferreting out the cause and effect relationship is difficult.

In the life insurance market, Fenn and Cole (1994) and Brewer and Jackson (2002) find that insurers with risky assets experience larger stock price declines than do those with less-risky assets during downturns in the real estate and bond markets. Baranoff and Sager (2007) observe reduced demand for life insurance products, as measured by the number of policies written, when ratings decline. Considering consumer influences, Zanjani (2002) finds a positive relationship between policyholder termination rates and insurer default risk. Liu, Epermanis, and Cox (2005) study the influence of guaranteed investment contracts (GICs) as a market disciplinary mechanism for bondholders. They find some market discipline influences, but that agency conflict risk-shifting behavior has a much stronger influence. The agency effects are far stronger in those instances when market discipline is undermined by informational limitations. For example, agency effects are more common among mutual insurers, which generally have lower informational requirements than do stock insurers. We interpret these results to mean that market discipline is an appropriate approach in some areas, but that regulatory efforts will work better in others. In particular, regulatory efforts are likely more appropriate where informational limitations exist. Market discipline will be more effective when information is generally available.

Looking at the effect of state guaranty associations, which are considered impediments to market discipline, a number of studies have observed increased risk-taking following the establishment of such associations (see Lee, Mayers, and Smith, 1997). At least one study also found that risk levels increased when the amount of insurance sold expanded in jurisdictions where guaranty associations exist (Brewer, Mondschean, and Strahan, 1997).

Insurance research often is limited by the fact that the majority of insurers are not publicly traded. As a result, nontrading market measures have been sought. One commonly used measure is a firm's credit rating. A.M. Best, Standard & Poor's, and Moody's each rate the majority of insurers. Several papers consider such ratings as measures of franchise value in order to study the influence of franchise value on firm risk. Yu, Lin, Oppenheimer, and Chen (2006) find that insurer investment in risky assets and the volatility of asset portfolios are inversely related to franchise value, i.e., ratings. This finding supports the notion that investors

impose market discipline to protect their franchise value. Zanjani (2002) used A.M. Best ratings as his measure of financial risk to study its relationship with life insurer termination rates. As noted above, he finds some evidence of market discipline, with a positive relationship between risk (i.e., ratings) and termination rates. And, as previously mentioned, Baranoff and Sager (2007) found that life insurance demand declined with rating decreases.

Epermanis and Harrington (2006) also consider insurer ratings and observe significant premium declines following rating downgrades, particularly for firms that had low ratings before the downgrade. They also note the concentration of premium declines in commercial lines, which tend not to be protected by guarantee associations. In the research reported here, we apply the Epermanis and Harrington methods to German data, allowing us to consider similarities and differences across markets. We further extend their work by considering alternative measures of market discipline (life insurance termination rates; see Zanjani, 2002) as well as alternative market discipline effects (complaint statistics).

3. HYPOTHESES, DATA, AND METHODOLOGY

3.1. HYPOTHESES

To develop our hypotheses on market discipline we distinguish between two types of market signal and two types of market reaction. Company ratings and complaint statistics are the two market signals we use as input variables for measuring market discipline. Premium growth and termination rates are the two output variables, which should represent market reaction to these signals. A significant dependence between the inputs and outputs should be an indication that market discipline exists. Table 1 summarizes the four hypotheses that can be derived by combining the two input variables with the two output variables.

Table 1: Hypotheses

Hypotheses	Market Signal = Input Variable	Market Reaction = Output Variable	Expected Influence Between Input and Output
1	Up/downgrade in company rating	Premium Growth	+/-
2	In/decrease in complaint statistics	Premium Growth	-/+
3	Up/downgrade in company rating	Termination Rates	-/+
4	In/decrease in complaint statistics	Termination Rates	+/-

Agency theory provides the theoretical foundation for our hypotheses. The agency cost literature, starting with Jensen and Meckling (1976), emphasizes incentives for increased risk taking associated with debt finance. Given risk-sensitive demand and franchise value, deterioration of an insurer's financial condition and the attendant increased insolvency risk should reduce new and renewal business as policyholders prefer higher-quality insurers.

Following Epermanis and Harrington (2006), we use change in company financial strength ratings as a proxy for change in the insurer's default risk. Based on agency theory, we expect that the market rewards declining default risk and penalizes rising default risk. Thus the first hypothesis is that an upgrade (downgrade) in company rating has a positive (negative) influence on the company's premium growth, i.e., we expect above-average premium growth when the company is upgraded and below-average premium growth if it is downgraded. To test this hypothesis we calculate abnormal premium growth using different definitions (see Section 3.3).

We also look at complaint statistics, seeing them as direct responses by policyholders to insurer service quality. Complaints might provide new insight into market discipline through their relationship with premium growth. There are a number of possible connections between complaints and premium growth. First, deterioration in insurer service quality, which should be reflected in complaints, might influence renewal decisions. Second, complaint statistics are often used as a promotion device by insurers and insurance agents. The complaint statistics can be found on the web pages of most insurance agents and on those of many insurers. We expect that an increase (decrease) in the number of complaints has a negative (positive) influence on premium growth (Hypothesis 2).

Termination rates are analyzed as a second variable that might be affected by market discipline (see Zanjani, 2002). Will consumers respond to an increase in default risk by canceling their life insurance contracts? If so, this would be strong evidence of market discipline. This question is the subject of Hypotheses 3 and 4. We expect, generally, the same response to the three market discipline input factors as with the premium growth. With termination rates, however, higher rates are worse for insurers than lower rates. Therefore, the sign of the hypothesis is opposite of anticipated effects on premium growth.

3.2. DATA

Premium Growth

We use data on gross premiums written and other financial information from the regulatory annual statements filed with the German Federal Financial Supervisory Authority (BaFin). Every company that operates in the insurance business in Germany must register with the BaFin (except for the publicly organized social insurance system). We thus have data for the entire German insurance market.

Before starting the analysis it was necessary to clean up the data, including dealing with changes in company names, mergers, acquisitions, and transfer of contracts. Because these events must be registered with the BaFin, we are able to identify them using the monthly notices published on the BaFin website. For a change in company name, we merged the corresponding time series. For mergers, acquisitions, and transfer of contracts, however, we omitted the year the transaction occurred from our sample in order to avoid a mixture of merger growth and operating growth.

The analyzed time period, 1996 to 2005, was an era of consolidation in the German insurance market. Especially important was the deregulation of the European Union financial services market in 1994, which created increasing competition due to market entry by foreign competitors and increasing market transparency. The trend toward consolidation continued after the stock market crash following the new economy bubble from 2001 to 2003, which took a heavy toll on the financial strength of German insurance companies. Table 2 illustrates the trend toward consolidation in the German insurance market by looking at the number of companies and the premiums (in billion €) per line of business (note that due to market entries and exits, the total number of companies (last column) is higher than the numbers presented for the individual years).

Table 2: Premium and termination rate data

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total
Life Insurance											
No. of companies	125	123	123	123	123	120	111	109	108	105	130
Premiums (bn €)	47.65	50.25	52.58	57.63	61.19	62.52	64.77	67.82	68.81	72.81	606.02
Prem./No. of cos.	0.38	0.41	0.43	0.47	0.50	0.52	0.58	0.62	0.64	0.69	4.66
Median termin. rate	12.90	14.20	13.80	9.65	13.50	12.90	14.90	13.70	13.00	19.00	13.50
Health Insurance											
No. of companies	57	56	57	56	55	55	55	54	54	53	63
Premiums (bn €)	17.55	18.60	19.38	19.98	20.78	21.81	23.16	24.84	26.51	27.44	220.05
Prem./No. of cos.	0.31	0.33	0.34	0.36	0.38	0.40	0.42	0.46	0.49	0.52	3.49
Property-Liability Insurance											
No. of companies	276	274	270	270	260	254	243	241	237	231	316
Premiums (bn €)	39.31	39.51	39.10	39.56	40.55	42.08	42.97	44.68	46.48	48.07	422.32
Prem./No. of cos.	0.14	0.14	0.14	0.15	0.16	0.17	0.18	0.19	0.20	0.21	1.34
Reinsurance											
No. of companies	35	37	44	42	40	40	43	44	45	45	52
Premiums (bn €)	29.29	31.88	32.02	35.35	39.33	43.92	53.52	50.09	47.18	45.33	407.90
Prem./No. of cos.	0.84	0.86	0.73	0.84	0.98	1.10	1.24	1.14	1.05	1.01	7.84
All											
No. of companies	493	490	494	491	478	469	452	448	444	434	561
Premiums (bn €)	133.80	140.24	143.08	152.52	161.84	170.32	184.42	187.44	188.99	193.65	1656.29
Prem./No. of cos.	0.27	0.29	0.29	0.31	0.34	0.36	0.41	0.42	0.43	0.45	2.95

Termination Rates

For life insurers, we also consider termination rates as a second effect of market discipline. When new information (e.g., a new rating) is obtained, termination rates may rise or decline depending on whether the information is negative or positive. The data are provided by the BaFin. The median termination rate per year is shown in Table 2. The termination rate is about 13% per year from 1996 to 2004, but then increases to 19% in 2005. We will control for this general increase by considering abnormal changes in termination rates, i.e., we make a market adjustment to isolate the individual effect of each insurer.

Financial Strength Ratings

To assess financial strength, we obtained company ratings from A.M. Best and Standard & Poor's—the two leading rating agencies in the German insurance market. Both provide financial strength ratings. These are independent opinions of an insurer's ability to meet its obligations to policyholders based on a comprehensive quantitative and qualitative evaluation of a company's balance sheet, operating performance, and business profile (see A.M. Best, 2007; Standard & Poor's, 2007). We obtained A.M. Best and Standard & Poor's ratings for all German insurers assigned a rating. A.M Best rates insurers on a scale from A++ (superior) to F (in liquidation), while Standard & Poor's ratings range from AAA (extremely strong financial security) to R (under regulatory supervision). We received 250 ratings of 34 insurers from A.M. Best and 1,252 ratings of 184 insurers from Standard & Poor's.[2] Table 3 provides an overview of the collected financial strength ratings and highlights the decline in financial strength after the stock market crash of 2000 to 2003.

From 1996 to 2000, many ratings are initial ratings, which demonstrates the increasing effort of German insurance companies to become more transparent after deregulation in 1994. Beginning in 2001, we observe the effects of the stock market plunge as there are increasing numbers of rating downgrades through 2003. Afterward, in 2004 and 2005, there is a more evenly balanced proportion

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[2] Thirty-one out of the 36 companies rated by A.M. Best are also rated by S&P. In our analysis, we present the combined effects of the Standard & Poor's and A.M. Best ratings, i.e., we added the smaller A.M. Best rating data to the S&P rating database. Duplicates (e.g., S&P up and A.M. Best up in the same year) were eliminated, reverse ratings (e.g., S&P up and A.M. Best down in the same year) could not be observed in the data. A separate analysis of both ratings, which is available upon request, yields comparable results.

between upgrading and downgrading. Note throughout Table 3 that the total number of ratings in a year can be above the total number of companies as some companies have more than one upgrade or downgrade in a year.

Table 3: Financial strength ratings of companies

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total
A.M. Best (250 ratings from 34 companies)											
Initial	10	5	1	5	0	0	3	2	3	5	34
Up	2	0	2	7	2	0	0	3	1	0	17
Down	1	0	0	1	0	1	7	13	3	0	26
Unchanged	0	9	15	9	19	22	32	19	27	21	173
Total	13	14	18	22	21	23	42	37	34	26	250
Standard & Poor's (1,252 ratings from 184 companies)											
Initial	16	10	40	29	41	23	10	7	3	5	184
Up	0	3	10	2	12	9	6	12	12	15	81
Down	0	2	1	3	11	27	62	72	13	10	201
Unchanged	0	14	18	60	74	101	103	108	153	155	786
Total	16	29	69	94	138	160	181	199	181	185	1252

Complaint Data

A second measure of market discipline comes from complaint statistics, which we obtained from the German regulator BaFin. The database contains 5,405 entries on the number of complaints involving 348 companies from all lines of business (except for reinsurance) between 1996 and 2005. As reporting complaints is obligatory, we know that the remaining companies had no complaints. The number of complaints decreased between 1996 and 2005. On a total industry level, the number of complaints per contract declined by more than 50% from 0.00015 (i.e., 150 complaints on 1 million contracts) in 1996 to 0.00007 in 2005. This decline might represent efforts by insurers to differentiate themselves as competition increased.

3.3. METHODOLOGY

Control Group Tests

We use the control group procedures presented by Epermanis and Harrington (2006) to estimate abnormal premium growth for downgraded and upgraded insurers (Hypothesis 1). We analyze log premium growth, $\Delta P_t = P_t - P_{t-1}$, where P_t is log premiums in year t. We have direct premiums for all lines of business, as well as premiums net of reinsurance for non-life and reinsurers. Growth in direct premiums represents the growth in premiums received directly from insurance buyers without regard to reinsurance, while net premium growth reflects the combined effects of changes in financial condition on direct premiums and the

firm's reinsurance decisions. For this analysis, we focused on the first effect (response of insurance buyers) and thus consider direct premiums only.

In the United States, most rating changes occur between January and July, with a substantial proportion occurring in June. Epermanis and Harrington (2006) therefore treat any rating change from August of year t – 1 through July of year t as a rating change in year t. As shown in Figure 1, we cannot observe similar behavior in the German insurance market, where rating changes seem to be more or less equally distributed throughout the year, with some peaks from October to March (note that most German companies publish their annual financial statements six to nine months after the end of the business year).

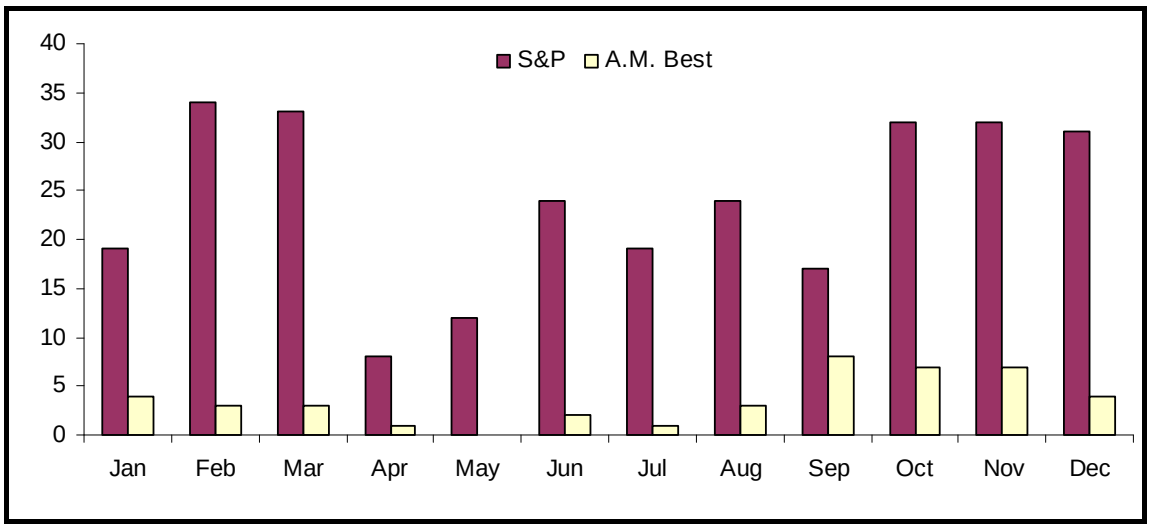

Figure 1: Number of rating changes by month

However, treating any rating change from August of year t – 1 through July of year t as a rating change in year t is reasonable not only because of the distribution of rating changes that Epermanis and Harrington (2006) observed, but also because the impact on growth for the calendar year would likely be modest. If a rating change occurs in November of year t, it can hardly affect premium growth in year t. We therefore decided to follow Epermanis and Harrington (2006) in their approach, but performed additional robustness tests, which show that this cutoff point does not affect our general results (these tests are available upon request).

Within the control group tests, abnormal premium growth is analyzed, i.e., premium growth of the insurer minus the premium growth in the market. We consider four different ways to determine abnormal premium growth.

- Definition 1: We adjust the insurer's premium growth in year t with the mean premium growth in the insurance market for the respective branch (life, non-life, health, reinsurance) in year t.
- Definition 2: An alternative less sensitive to outliers is to calculate the abnormal premium growth using the median premium growth in the industry.
- Definition 3: All insurers are ranked by their premiums in year t and the mean premium growth is calculated for three size groups (large, medium, small). The premium growth for the insurer in year t minus the growth rate for insurers in its size group is called "size-adjusted mean abnormal premium growth."
- Definition 4: If the size adjustment is made on a median basis, this leads to the "size-adjusted median abnormal premium growth."

We analyze the year of a rating change (t) as well as the year before ($t - 1$) and the year after ($t + 1$). Calculating abnormal premium growth for the years before and following a rating change decreases the sample size because of the limitations of the investigation period. For example, when a rating changes in 2005, we can determine the abnormal premium growth for $t - 1$ to t, but not for $t + 1$, because the sample period ends in 2005. Although our data contain all financial strength ratings available for the German market, the sample size is relatively small. For example, for life insurance the sample of upgraded companies is 31 and the sample of downgraded companies is 61. Due to this small sample size, we do not distinguish between different rating categories when calculating premium growth at the industry level. Later regression analyses allow us to analyze different rating categories that are especially relevant at the rating cutoff points between A and B. These limitations of the sample size, however, are relevant only for the financial strength ratings and not for the complaint statistics or the termination rates. For these two, we have full coverage of the market, which allows a much broader analysis.

In the second step, we use the same control group procedures to analyze abnormal premium growth related to changes in the number of complaints in the German insurance industry (Hypothesis 2). The basic idea here is to split the total sample into two groups. The first group is comprised of those companies that experienced a decrease in the number of complaints in year t, and the second group contains those insurers with an increase in the number of complaints in year t. To compare insurers of different size, we do not analyze the absolute number of complaints, but relate it to the number of contracts. Furthermore, we analyze abnormal developments in complaint statistics, i.e., we subtract the aver-

age number of complaints per contract in the market from the insurer's individual number. Again, we consider the year *t* (change in complaints) as well as the year before (*t* – 1) and the year after (*t* + 1) and present mean and median abnormal premium growth for the unadjusted and the size-adjusted sample (using the above presented Definitions 1 to 4). The same procedure is used to analyze a company's financial strength ratings and complaint statistics and their effects on termination rates (Hypotheses 3 and 4).

Regression Tests

Within the control group tests, we can focus only on the dependency between one input variable and one output variable, thereby conditioning on different size categories and points in time. To incorporate additional explanatory variables for premium growth in our analysis, we estimate a regression model that conditions on additional variables such as prior premium level or legal form. The model structure and the choice of the additional variables is motivated by Epermanis and Harrington (2006), which allows us to compare our German results with the results for the United States. Our regression equation for the analysis of financial strength ratings is given as:

$$\Delta P_{jt} = E(\Delta P_{jt} \,|\, \text{no rating change}) + \delta' RC_{jt} + \varepsilon_{jt}\,. \tag{1}$$

The dependent variable is log premium growth for insurer *j* in year *t* (ΔP_{jt} = $\ln(P_{jt}/P_{jt-1})$). RC_{jt} is a vector of rating downgrade and upgrade indicator variables:

$$RC'_{jt} = \left[RC^{Up}_{jt\text{-}1}, RC^{Up}_{jt}, RC^{Up}_{jt+1}, RC^{Down}_{jt\text{-}1}, RC^{Down}_{jt}, RC^{Down}_{jt+1} \right]. \tag{2}$$

For example, RC^{Up}_{jt-1} equals 1 if insurer *j* has been upgraded in year *t – 1* and 0 otherwise. When analyzing rating changes, we consider a three-year window (*t* – 1, *t*, and *t* + 1). ε_{jt} in Equation (1) is a mean-zero disturbance. $E(\Delta P_{jt} \,|\, \text{no rating change})$ represents the expected premium growth conditional on no rating change, which is given by:

$$E(\Delta P_{jt} \,|\, \text{no rating change}) = \beta' X_{jt} + \lambda' T + \nu_j\,, \tag{3}$$

where T is a vector of nine indicator variables representing the years 1997 to 2005. v_j is an unobservable, time-invariant effect for firm *j*. X_{jt} is a vector containing the following firm characteristics:

$$X'_{jt} = \left[P_{jt-1}, Mutual_{jt-1}, A_{jt-1}, Low_{jt-1} \right]. \tag{4}$$

P_{jt-1} are the log premiums for firm j in $t-1$. $Mutual_{jt-1}$ equals 1 if insurer j in year $t-1$ is a mutual, 0 otherwise. A_{jt-1} equals 1 if rating is A, Low_{jt-1} equals 1 if rating is B or below. Although Standard & Poor's and A.M. Best use slightly different scales to assign their ratings, we concentrate on the cutoff between A and B, given its empirical importance in the insurance market (see Epermanis and Harrington, 2006; we also produced results for the lower cutoff point between investment grade and noninvestment grade, which are available upon request). Due to the small sample available, we do not focus on A– rated companies, but on the broader category of A rated companies, which results in comparable groups of sufficient size.

Complaint statistics are analyzed as a second market signal. We want to use a regression approach for the complaint statistics that is comparable to the regression equation for financial strength ratings. One way to do this is to replace the variable *RC* by a new variable *CS* representing changes in complaint statistics:

$$\Delta P_{jt} = E(\Delta P_{jt}) + \delta' CS_{jt} + \varepsilon_{jt}, \text{ with} \tag{5}$$
$$E(\Delta P_{jt}) = \beta' X_{jt} + \lambda' T + \nu_t,$$
$$CS'_{jt} = \left[CS^{Up}_{jt\text{-}1}, CS^{Up}_{jt}, CS^{Up}_{jt+1}, CS^{Down}_{jt\text{-}1}, CS^{Down}_{jt}, CS^{Down}_{jt+1} \right], \text{ and}$$
$$X'_{jt} = \left[P_{jt-1}, Mutual_{jt-1}, CSHigh_{jt-1} \right].$$

CS' contains a vector of complaint upward movements and downward movements. *CSHigh* are those companies in the upper decile of the complaint statistics, i.e., those companies that have the highest number of complaints per contract.

Using the same approach, we replace premium growth by the termination rates—the second market reaction that we use in our analysis. The model for termination rates (*TR*) and rating changes is then given by:

$$\Delta TR_{jt} = E(\Delta TR_{jt} \,|\, \text{no rating change}) + \delta' CS_{jt} + \varepsilon_{jt}, \text{ with} \tag{6}$$
$$RC'_{jt} = \left[RC^{Up}_{jt\text{-}1}, RC^{Up}_{jt}, RC^{Up}_{jt+1}, RC^{Down}_{jt\text{-}1}, RC^{Down}_{jt}, RC^{Down}_{jt+1} \right], \text{ and}$$
$$X'_{jt} = \left[P_{jt-1}, Mutual_{jt-1}, B+_{jt-1}, Low_{jt-1} \right].$$

The regression model for termination rates (*TR*) and complaint statistics is calculated as follows:

$$\Delta TR_{jt} = E(\Delta TR_{jt}) + \delta' CS_{jt} + \varepsilon_{jt}, \text{ with} \quad (7)$$

$$CS'_{jt} = \left[CS^{Up}_{jt\text{-}1}, CS^{Up}_{jt}, CS^{Up}_{jt+1}, CS^{Down}_{jt\text{-}1}, CS^{Down}_{jt}, CS^{Down}_{jt+1} \right],$$

$$E(\Delta P_{jt}) = \beta' X_{jt} + \lambda' T + \nu_t, \text{ and}$$

$$X'_{jt} = \left[TR_{jt-1}, Mutual_{jt-1}, CSHigh_{jt-1} \right].$$

We estimated all models using (a) least squares with standard errors that are robust to heteroskedasticity and within-firm correlation of disturbances and (b) fixed effects. A Hausman test rejected the null hypothesis that firm fixed effects are uncorrelated with the regressors, which indicates that the least squares estimates are inconsistent. We thus focus on the fixed-effects regression when presenting the results.

Table 4 is a summary of our data and hypotheses. We do not analyze ratings for health insurers as the sample size is too small: we have only eight downgraded insurers and no upgraded insurers, making an analysis infeasible. All tests on financial strength ratings reflect the behavior only of rated insurers, i.e., we consider only companies that received a rating. For the analysis of complaint statistics, we extend our focus to all insurers that have complaint statistics, which will allow a broader analysis. Complaint statistics are collected only for insurance sold to individuals. Thus there are no complaint statistics for reinsures. Furthermore, termination rates are collected only for life insurance.

Table 4: Hypotheses and data available

	Hypothesis 1	Hypothesis 2	Hypothesis 3	Hypothesis 4
Input/Independent Variable	Financial Strength Ratings	Complaint Statistics	Financial Strength Ratings	Complaint Statistics
Output/Dependent Variable	Premium Growth	Premium Growth	Termination Rates	Termination Rates
Life	56 rated companies (31/61 up-/downgraded 1995 to 2005)	81 (all companies with complaint statistics)	56 rated companies (31/61 up-/downgraded 1995 to 2005)	81 (all companies with complaint statistics)
Health	/	53 (all companies with complaint statistics)	/	/
Non-Life	85 rated companies (41/77 up-/downgraded 1995 to 2005)	204 (all companies with complaint statistics)	/	/
Reinsurance	30 rated companies (20/44 up-/downgraded 1995 to 2005)	/	/	/

4. RESULTS

We start our analysis with a comparison of the different rating classes and the corresponding growth and termination rates. In Table 5 we use the Standard & Poor's rating data as an example. We distinguish between three groups of rating quality: above A (high), A, and below A (low). The premium data start in 1996, so we can analyze nine years of premium growth (from 1997 to 2005). Due to market entries and exits, the firm years of the full sample is not 1,170 for the life insurers (130 companies times 9 years of premium growth data), but only 942 years. The same holds for the other lines of business.

Table 5: Summary statistics (premium growth and termination rate by rating class (Standard & Poor's))

		Number of firm years	Average premium growth 1997–2005		Average termination rate 1997–2005	
			Mean	Median	Mean	Median
Life Insurance						
Rated	High (above A)	44	5.80%	4.47%	14.19	14.90
	A	105	4.33%	3.48%	14.60	12.70
	Low (below A)	108	3.01%	2.80%	19.12	14.85
All rated companies		257	4.02%	3.48%	16.45	13.80
Full sample (including not rated insurers)		942	4.99%	3.59%	17.99	14.70
Non-Life Insurance						
Rated	High (above A)	89	4.31%	2.21%	/	/
	A	167	2.39%	2.12%	/	/
	Low (below A)	107	2.52%	2.03%	/	/
All rated companies		363	2.90%	2.11%	/	/
Full sample (including not rated insurers)		1858	4.38%	3.77%	/	/
Reinsurance						
Rated	High (above A)	50	7.88%	8.07%	/	/
	A	22	5.17%	7.55%	/	/
	Low (below A)	32	-2.75%	-1.91%	/	/
All rated companies		104	4.04%	4.34%	/	/
Full sample (including not rated insurers)		237	2.83%	2.31%	/	/

The evidence suggests a connection between company risk in terms of Standard & Poor's ratings and premium growth. We find decreasing premium growth with increasing levels of risk. Considering the sample of life insurers (upper part of Table 5), companies with a high rating (above A) on average grow at a rate of 5.80%, while companies with a low rating (below A) grow at a rate of 3.01%. Comparing the sample of rated companies with the sample of nonrated companies, we find that premium growth is lower for rated companies—4.02% on average compared with 4.99% for nonrated companies. This could be because rated companies tend to be larger than the nonrated companies and smaller companies

might on average grow faster (see Doherty, Kartasheva, and Phillips, 2008, for a related discussion). The connection between company risk and premium growth results can also be observed for non-life and reinsurance companies (middle and lower part of Table 5). With non-life insurers the premium growth in the full sample (4.38%) is again much higher than for the rated companies (2.90%), but this relationship does not hold for reinsurers.

For the sample of life insurers, we also find increasing termination rates with increasing levels of risk. Companies with a high rating have a termination rate of 14.19%, whereas this value is 19.12% for the low-rated companies. The results for medians are more mixed. Comparing the sample of rated companies with the sample of nonrated companies, we find that on average the rated companies tend to have lower termination rates (16.45% vs. 17.99%). Note, however, that these differences are not statistically significant and we thus cannot conclude that the sample of rated companies is different from the full sample.

4.1. CONTROL GROUP TESTS

Effect of Rating Change on Premium Growth (Hypothesis 1)

There could be several reasons for the above observations on premium growth, ratings, and termination rates. To control for some of them, we use the control group procedures presented by Epermanis and Harrington (2006) to estimate abnormal growth for downgraded and upgraded insurers (Hypothesis 1). Table 6 presents mean and median abnormal premium growth and the corresponding p-values for the sample of life, non-life, and reinsurance companies. We consider the unadjusted and the size-adjusted sample using Definitions 1 to 4 (see Section 3.3). The null hypothesis for the one-tailed t-test is that the abnormal premium growth equals 0 against abnormal premium growth > 0 for the upgraded insurers and abnormal premium growth < 0 for the downgraded insurers.

After an insurer's financial strength rating is downgraded, we find slower premium growth in all lines of business. This is a consistent result for both the unadjusted and the size-adjusted samples, although there are differences in timing and for the different measures. Considering the size-adjusted results as an example, in the year of the rating change the mean abnormal premium growth for life insurers is –1.73%. and –3.69% for reinsurers. While abnormal premium growth is negative and statistically significant for reinsurers both for the mean and the median, for life insurers only the mean value is significant. The small sample size results in differences between means and medians. We therefore sometimes observe sig-

nificant results only for means or only for medians, but not for both. For non-life insurers, we find clear negative effects in the year following the rating downgrade, while the evidence for year t is mixed. It thus seems that for non-life companies, the negative effect of a downgrade becomes evident with a time lag of one year. In the year before a downgrade, however, we observe no significant change in abnormal premium growth.

Table 6: Results for Hypothesis 1 (effect of changes in company financial strengths ratings on abnormal premium growth)

Time		**t-1**	**t**	**t+1**	**t-1**	**t**	**t+1**
		Upgraded insurers			**Downgraded insurers**		
Life Insurance (31 upgraded/61 downgraded insurers)							
Unad-justed	Mean (%)	4.06	-0.11	1.81	-1.08	-1.80	-0.43
	P-Value	0.13	0.53	0.18	0.16	**0.04****	0.38
	Median (%)	2.53	1.11	0.91	0.28	-0.49	-0.38
	P-Value	0.17	0.23	0.32	0.60	0.31	0.40
Size-adjust.	Mean (%)	3.20	-0.38	1.75	-1.08	-1.73	-0.82
	P-Value	0.11	0.59	0.21	0.14	**0.04****	0.28
	Median (%)	1.13	0.64	-0.21	0.07	-0.05	-0.26
	P-Value	0.34	0.34	0.54	0.53	0.48	0.43
Non-Life Insurance (41 upgraded/77 downgraded insurers)							
Unad-justed	Mean (%)	-1.01	0.58	-0.58	0.20	0.40	-2.85
	P-Value	0.82	0.38	0.70	0.56	0.61	**0.01****
	Median (%)	-0.31	-0.07	0.22	0.05	-0.83	-1.74
	P-Value	0.61	0.52	0.42	0.51	0.28	0.17
Size-adjust.	Mean (%)	-0.20	1.15	0.22	0.44	0.79	-1.99
	P-Value	0.57	0.26	0.41	0.63	0.72	**0.04****
	Median (%)	-0.20	-0.10	0.64	0.22	-0.06	-1.47
	P-Value	0.57	0.52	0.28	0.57	0.48	0.10
Reinsurance (20 upgraded/44 downgraded insurers)							
Unad-justed	Mean (%)	-5.86	-0.95	-4.80	4.18	-1.82	-3.23
	P-Value	0.89	0.68	0.97	0.96	0.22	0.14
	Median (%)	-1.86	-1.39	-3.47	4.02	-3.79	-1.52
	P-Value	0.64	0.75	0.92	0.96	**0.06***	0.31
Size-adjust.	Mean (%)	-8.54	-4.92	-8.16	2.77	-3.69	-3.05
	P-Value	0.97	0.99	1.00	0.88	**0.05***	0.14
	Median (%)	-1.67	-4.39	-3.28	0.00	-3.36	0.00
	P-Value	0.63	0.98	0.91	0.50	**0.08***	0.50

*** (**, *): Significant at the 1% (5%, 10%) level.

After an upgrade in a company's financial strength rating, no significant effects on premium growth can be observed. This is consistently true for all lines of business, for means and medians, and for unadjusted as well as size-adjusted growth numbers. The finding that there are significant premium declines after downgrading and no significant premium increases after upgrading corresponds to the findings of Epermanis and Harrington (2006) for the U.S. market. The clarity and significance of our results, however, are not as great as for Epermanis and Harrington. For example, in their control group tests, premium growth is negative and significant in the year of *and* the year following a downgrade. In our sample, the effect can only be found in the year of *or* the year following the

downgrade. Moreover, in Epermanis and Harrington (2006), the premium decline was 4–12%, while in our case the reduction is about 2–4%. The negative market reaction to rating downgrades, therefore, is not as strong nor as longstanding in the German insurance market as in the U.S. market.

Furthermore, for upgraded reinsurers, we find a strong decrease in abnormal premium growth, e.g., for the size-adjusted sample by 8.54%, 4.92%, and 8.16% in $t - 1$, t, and $t +1$ (mean values at the bottom of Table 6), which is contrary to our expectations. This might be due to some endogeneity that is not observable in our control group tests. In the reinsurance market, firms with slower growth might be showing signs of strengths, including underwriting discipline, whereas faster-growing reinsurers might be financially weaker companies (see Harrington, Danzon, and Epstein, 2008, for an example in medical malpractice). Later regression tests (see Section 4.2) that control for fixed year and fixed firm effects do not show decreasing premium growth for upgraded reinsurers, which confirms our hypothesis that some endogeneity is driving this unexpected result. However, future research is necessary to evaluate which factors exactly can explain the observed pattern in the reinsurance market.

Effect of Change in Number of Complaints on Premium Growth (Hypothesis 2)

In the second step, we analyze the relationship between abnormal premium growth and changes in the number of complaints. Again, we consider the year t (change in complaints) as well as the year before ($t - 1$) and the year after ($t + 1$) and present mean and median abnormal premium growth in Table 7. The left part of the table presents the results for a decrease in the number of complaints per contract, which might be comparable to an upgrade in rating because both situations represent an improvement in the company's situation. We interpret both as a positive signal to market participants. In contrast, an increase in the number of complaints might be a bad signal, comparable to a downgrade.

We observe little evidence that either the positive market signal or the negative market signal, as measured by a decrease (increase) in the number of complaints, has an influence on premium growth in the German insurance market. The only significant premium decline that we can report is a decline for health insurers the year following an increase in the number of complaints for the unadjusted sample. The fact that these premium declines happen in year $t + 1$ instead of year t might indicate that there is a time lag for the realization of negative news with the complaint statistics, as previously observed for non-life insurers and ratings.

However, overall, it seems that the influence of complaint statistics on premium growth is limited, especially compared to the ratings.

Table 7: Results for Hypothesis 2 (effect of changes in complaints per contract on abnormal premium growth)

Time		**t-1**	**t**	**t+1**	**t-1**	**t**	**t+1**
		Decrease in complaints per contract			**Increase in compl. per contract**		
Life Insurance (81 insurers)							
Unad-justed	Mean (%)	0.83	-0.86	-0.63	0.73	0.44	-0.48
	P-Value	0.16	0.70	0.62	0.82	0.74	0.22
	Median (%)	-0.01	0.40	0.27	-0.02	-0.20	-0.48
	P-Value	0.51	0.41	0.45	0.49	0.38	0.22
Size-adjust.	Mean (%)	1.06	-0.89	-0.91	0.73	1.03	0.18
	P-Value	0.10	0.71	0.68	0.82	0.89	0.61
	Median (%)	0.06	0.09	0.15	0.00	0.00	-0.23
	P-Value	0.47	0.48	0.47	0.50	0.50	0.36
Non-Life Insurance (204 insurers)							
Unad-justed	Mean (%)	-1.80	0.87	0.04	2.16	-0.95	-0.66
	P-Value	0.87	0.30	0.48	0.84	0.25	0.40
	Median (%)	-0.05	-0.03	0.10	0.06	0.03	-0.27
	P-Value	0.51	0.51	0.43	0.51	0.51	0.46
Size-adjust.	Mean (%)	-1.80	0.58	0.19	2.50	-0.57	-0.30
	P-Value	0.88	0.36	0.37	0.88	0.34	0.45
	Median (%)	-0.05	-0.03	0.24	0.04	0.14	-0.27
	P-Value	0.51	0.51	0.32	0.51	0.54	0.46
Health Insurance (53 insurers)							
Unad-justed	Mean (%)	0.22	-0.60	0.10	-0.52	0.41	-0.52
	P-Value	0.38	0.85	0.43	0.25	0.71	0.21
	Median (%)	0.39	0.35	0.22	-0.61	-0.48	-0.88
	P-Value	0.31	0.32	0.37	0.19	0.21	**0.05****
Size-adjust.	Mean (%)	0.27	-0.35	0.25	-0.18	0.61	-0.22
	P-Value	0.33	0.73	0.33	0.40	0.82	0.35
	Median (%)	0.02	0.00	0.23	0.00	0.00	-0.11
	P-Value	0.49	0.50	0.36	0.50	0.50	0.41

*** (**, *): Significant at the 1% (5%, 10%) level (one-tailed t-test).

Effect of Rating Change and Change in Number of Complaints on Life Insurance Termination Rates (Hypotheses 3 and 4)

We also analyzed the influence of financial strength ratings and complaint statistics on termination rates, our second measure of market discipline. Table 8 is similar to Tables 6 and 7 and summarizes the results of Hypotheses 3 and 4. As before, the "good" signal (upgrade, decrease in complaints) is presented on the left and the "bad" signal (downgrade, increase in complaints) on the right.

For Hypothesis 3, the effect of rating changes on termination rates, we again find a significant impact for the negative market signal and no impact for the positive market signal. A significant increase in termination rates is found in both means and medians following the year of a rating downgrade, but we cannot identify any effects on abnormal premium growths for an upgraded insurer.

Table 8: Results for Hypotheses 3 and 4 (effect of changes in company ratings/complaints per contract on abnormal termination rates)

Time		**t-1**	**t**	**t+1**	**t-1**	**t**	**t+1**
Hypothesis 3		**Upgraded insurers**			**Downgraded insurers**		
Life Insurance (31 upgraded/61 downgraded insurers)							
Unad-justed	Mean (%)	-2.87	4.46	-4.73	1.81	3.80	6.43
	P-Value	0.20	0.78	0.14	0.32	**0.09***	**0.02****
	Median (%)	-1.37	8.04	-4.55	-2.77	0.41	5.72
	P-Value	0.35	0.91	0.15	0.76	0.44	**0.04****
Size-adjust.	Mean (%)	-2.73	4.21	-3.77	2.35	3.24	5.36
	P-Value	0.20	0.77	0.16	0.27	0.13	**0.04****
	Median (%)	-1.30	1.66	-2.81	-0.89	0.00	3.19
	P-Value	0.35	0.61	0.24	0.59	0.50	0.17
Hypothesis 4		**Decrease in complaints per contract**			**Increase in compl. per contract**		
Life Insurance (81 insurers)							
Unad-justed	Mean (%)	2.25	-1.98	-2.32	-2.89	2.14	1.25
	P-Value	0.88	0.14	**0.10***	0.94	**0.10***	0.27
	Median (%)	0.45	-1.79	-0.83	-1.66	0.62	0.72
	P-Value	0.59	0.17	0.32	0.82	0.36	0.36
Size-adjust.	Mean (%)	3.68	-1.25	-2.75	-1.88	2.29	1.70
	P-Value	0.97	0.26	**0.08***	0.83	**0.10***	0.21
	Median (%)	1.83	-0.89	0.00	0.00	1.90	0.29
	P-Value	0.82	0.32	0.50	0.50	0.14	0.44

*** (**, *): Significant at the 1% (5%, 10%) level (one-tailed t-test).

Considering the effects of complaint statistics on termination rates (Hypothesis 4), we find decreases in the termination rates one year after the number of complaints decreases. When the number of complaints increases, we find that the termination rates increase, e.g., by 2.14% on average in the unadjusted sample. This increase in termination rate is significant both for the unadjusted and the size-adjusted sample.

Overall, the control group tests show that the impact negative market signals is stronger than the impact of good market signals. While an improvement of a company's situation (upgrading, decrease in complaints per contract) has only very limited influence on premium growth and termination rates, a negative development (downgrading, increase in complaints per contract) appears to be more relevant to market participants. Furthermore, all the tests indicate that the impact of financial strength ratings on premium growth and termination rates is higher than the impact of complaint statistics. The financial strength rating showed significant results under a variety of different settings, whereas complaint statistics seem to be important for termination rates, but not for premium growth.

4.2. REGRESSION TESTS

Effect of Rating Change on Premium Growth (Hypothesis 1)

In this section we analyze whether the results found for the control group tests also hold for the regression models presented in Section 3.3. The fixed-effects estimators for Hypothesis 1 are reported along with the adjusted R-squared in the upper part of Table 9. The coefficients on the rating change variables provide estimates of differences in mean premium growth among the groups conditioning on firm size (log premiums), prior growth, ownership form, and rating category.

Table 9: Results for Hypothesis 1 and 2 (effect of changes in company ratings and complaints per contract on abnormal premium growth)

		Est.	P-Val.	Est.	P-Val.	Est.	P-Val.
Hypothesis 1		**Life**		**Non-Life**		**Re**	
Controls	Ln Premiums t-1	-0.10	**0.00*** **	-0.02	**0.04** **	-0.02	0.73
	Mutual	-0.11	**0.00*** **	-0.05	**0.00*** **	0.04	0.53
Rating	A	-0.01	0.26	-0.01	0.56	-0.04	0.28
	Low	-0.02	0.13	-0.02	0.29	-0.04	0.67
Upgrades	Rating Up t-1	0.04	**0.09***	0.00	1.00	0.03	0.51
	Rating Up t	-0.02	0.40	0.06	**0.03** **	0.01	0.85
	Rating Up t+1	0.01	0.48	-0.02	0.30	0.01	0.83
Downgrades	Rating Down t-1	-0.03	**0.09***	0.03	0.23	0.07	0.10
	Rating Down t	-0.04	**0.01*** **	0.03	0.20	-0.06	0.17
	Rating Down t+1	-0.01	0.51	-0.05	**0.08***	-0.03	0.53
Adjusted R-squared		0.25		0.16		0.28	
Hypothesis 2		**Life**		**Non-Life**		**Health**	
Controls	Ln Premiums t-1	-0.10	**0.00*** **	0.03	0.33	-0.20	**0.00*** **
	Mutual	0.07	0.25	0.14	0.19	-0.72	**0.00*** **
Level of complaints	CS High	-0.01	0.62	0.04	**0.08***	-0.02	0.17
Decrease in complaints	CS Down t-1	0.05	0.17	-0.05	0.35	0.00	0.83
per contract	CS Down t	-0.03	0.29	-0.05	0.14	0.02	0.24
	CS Down t+1	0.00	0.84	0.00	0.87	-0.01	0.76
Increase in complaints	CS Up t-1	0.05	0.91	-0.05	0.35	0.00	0.87
per contract	CS Up t	-0.05	0.14	-0.05	0.12	0.00	0.78
	CS Up t+1	-0.02	0.37	0.01	0.82	-0.01	0.57
Adjusted R-squared		0.34		0.17		0.68	

*** (**, *): Significant at the 1% (5%, 10%) level (two-tailed t-test).

The implications of the regressions are mostly consistent with those of the control group tests. There is a significant impact of upgrades on premium growth for non-life insurers. However, stronger effects can be observed for a downgrading, where we find significant premium declines both for life and non-life insurers.

There are two differences between the results of the regressions and those of the control group tests. First, in the regressions, none of the estimators in the reinsurance sample are significant. The prior unexpected results for reinsurers in the

control group tests, therefore, might be driven by the conditions associated with our control variables (premium level, legal form, rating level, fixed years, and, especially, fixed firm effects; note that with the least squares estimates that do not account for fixed effects, the results are more in line with the control group tests; these results are available upon request). The second difference is that we find significant results for life insurers in the year before an upgrade or a downgrade. In this case, fixed year effects seem to be very important because eliminating the indicator variables for fixed years in the regression yields exactly the same results observed under the control group tests, suggesting the existence of a time-related influence in the life insurance market.[3]

The coefficients for log premiums are negative and statistically significant for life and non-life insurers, which suggests that premium growth is negatively related to firm size. The results for the control variable "mutual" is also significant and in line with the findings of Epermanis and Harrington (2006). Reconsidering the results from Table 5, a negative impact of the two rating variables (A and Low) on premium growth could be expected. And, indeed, both coefficients always have a negative sign, but they are not significant.

Effect of Change in Number of Complaints on Premium Growth (Hypothesis 2)

The fixed-effects estimators for Hypothesis 2 (change in the number of complaints per contract and the effect on the premium growth) are reported in the lower part of Table 9. Many control variables are significant. For non-life insurers, we find that a high level of complaints is positively related to premium growth (as indicated by the variable CS High). The premium level of the prior year (Ln Premiums t-1) seems to be much more important for the premium growth of health insurers than for the life- and non-life business. The low p-value of the prior premium level is also the main driver for the high adjusted R-squared of the health insurers. Again, this indicates a size effect—small health insurers grow faster than large health insurers. In a regression without the variable LN Premiums t-1, we again find a significant premium decline for health insurers the year following an increase in the number of complaints. This confirms the find-

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[3] This time-related influence might be the stock market crash following the new economy bubble from 2001 to 2003 (see Table 3). To control for this, we added the yearly returns of the MSCI Germany stock market index as a variable in the regression. In this extended regression, the estimator for downgrading (Rating Down t-1) is not significant, which seems consistent with our expectation.

ings from Table 7, where an increase in the number of complaints is significant for the unadjusted sample, but not significant for the size-adjusted sample. The variable CS Up t is also negative for life and non-life, but the estimators are not significant. The evidence for complaint statistics thus confirms the results from the control group procedures.

Effect of Rating Change and Change in Number of Complaints on Life Insurance Termination Rates (Hypotheses 3 and 4)

Table 10 is structured like Table 9 and analyzes the influence of financial strength ratings and complaint statistics on termination rates, our second measure of market reaction, for the sample of life insurers. The left part of Table 10 shows the fixed-effects estimators for the ratings (Hypothesis 3) and the right part the fixed-effects estimators for complaint statistics (Hypothesis 4).

Table 10: Results for Hypotheses 3 and 4 (effect of changes in company ratings/complaints per contract on abnormal termination rates)

Hypothesis 3		**Life Insurance**		**Hypothesis 4**		**Life Insurance**	
		Est.	P-Val.			Est.	P-Val.
Controls	Ln Premiums.t-1	0.15	**0.02****	Controls	Ln Premiums.t-1	0.13	**0.01*****
	Mutual	0.31	**0.09***		Mutual	0.26	0.14
Rating	A	-0.02	0.63	Level of complaints	CS High	0.00	0.94
	Low	0.00	0.99				
Upgrades	Rating Up t-1	-0.03	0.52	Decrease in complaints	CS Down t-1	0.11	0.45
	Rating Up t	0.05	0.54	per contract	CS Down t	0.15	0.27
	Rating Up t+1	-0.09	0.13		CS Down t+1	-0.02	0.85
Downgrades	Rating Up t-1	0.00	0.94	Increase in complaints	CS Up t-1	0.14	0.36
	Rating Up t	0.01	0.85	per contract	CS Up t	0.07	0.59
	Rating Up t+1	0.05	0.33		CS Up t+1	-0.06	0.51
Adjusted R-squared		0.31				0.34	

*** (**, *): Significant at the 1% (5%, 10%) level (two-tailed t-test).

Neither rating changes nor complaint statistics have a significant impact on termination rates. The control variables seem to be more important drivers for the termination rates. The coefficients for log premiums and mutual are positive and significant. Thus, taking the regression results into consideration, there appears to be no evidence that ratings or complaints have a significant impact on termination rates.[4]

[4] Zanjani (2002) also does not find an effect for changes in rating, but finds an effect for the rating itself (comparable to our test in Table 5). Our results are therefore consistent with this literature.

The evidence regarding the effect of ratings and complaints on termination rates is thus limited to the control group tests, while the impact on premium growth is confirmed both by the control group tests and the regression tests. Another point of interest concerns the various degrees of impact made by positive and negative signaling. The positive market signal shows only a limited positive effect, if any; a negative market signal has much stronger and, of course, negative, impact.

5. CONCLUSION

Insurance regulators in the European Union are expending significant resources on revising regulatory requirements for member-nation companies. One option being discussed in the context of developing these requirements is to improve market discipline. To assist regulators in achieving the proper balance between efforts to improve market discipline and imposition of strict capital and other requirements, we examine the role of ratings and other market factors on premium growth.

Consistent with our expectations, there is some market discipline in the German insurance industry. That is, the market reacts to information generally in the expected manner. We find significant premium declines (or increased termination rates in life insurance) following rating downgrades and reduced consumer satisfaction as measured by changes in complaint statistics. Rating upgrades or improvements in consumer satisfaction do not appear to affect premium volume. These findings are consistent with Epermanis and Harrington (2006) findings for the United States, and with studies of other financial services markets, such as Sironi (2003) or King (2008) for the banking industry. The asymmetry between reaction to positive and negative information is also consistent with results of analyses conducted outside the insurance industry (see Chan, 2003; Hong, Lim, and Stein, 2000; Schmitz, 2007).

Our findings, however, are less clear than those reported for the U.S. market. We therefore conclude that market discipline in the German insurance market is not as strong as it is in the United States. This result has important implications for regulators because if they want market discipline to be the foundation of a solvent insurance industry, they will need to implement measures to improve it. One market discipline tool worth consideration is posting insurer financial strength ratings on the regulator's web page, similar to what is done in New Zealand (see Insurance Council of New Zealand, 2008). Publishing the ratings would make the regulator's web page a valuable source of information and

might be a spur toward increasing market discipline in the German and EU insurance industry.

We provide a broad evaluation of market discipline for a large sample of German insurance companies based on all available financial strength ratings, complaint statistics, and termination rates, but the data are still limited. This is especially true for health insurance companies, a market we were not able to investigate in this paper due to the small sample size. Decisionmakers and regulators would benefit from additional research that takes other markets into consideration, both those within the European Union and those outside it.

REFERENCES

A.M. Best, 2007, Guide to Best's Financial Strength Ratings, http://www.ambest.com/ratings/guide.asp?l=1&Menu=Ratings+Definitions,Financial+Strength.

Adams, M., B. Burton, and P. Hardwick, 2003, The Determinants of Credit Ratings in the United Kingdom Insurance Industry, *Journal of Business Finance & Accounting*, 30(3): 539–572.

Baranoff, E. G., and T. W. Sager, 2007, Market Discipline in Life Insurance: Insureds' Reaction to Rating Downgrades in the Context of Enterprise Risks, Working Paper.

Brewer, E., and W. E. Jackson, 2002, Inter-Industry Contagion and the Competitive Effects of Financial Distress Announcements: Evidence from Commercial Banks and Insurance Companies, Federal Reserve Bank of Chicago Working Paper No. 2002-23.

Brewer, E., T. Mondschean, and P. Strahan, 1997, The Role of Monitoring in Reducing the Moral Hazard Problem Associated with Government Guarantees: Evidence from the Life Insurance Industry, *Journal of Risk and Insurance*, 64: 302–322.

Chan, W. S., 2003, Stock Price Reaction to News and No-News: Drift and Reversal After Headlines, *Journal of Financial Economics*, 70: 223–260.

Cummins, J. D., and P. M. Danzon, 1997, Price, Financial Quality, and Capital Flows in Insurance Markets, *Journal of Financial Intermediation*, 6: 3–38.

Distinguin, I., P. Rous, and A. Tarazi, 2006, Market Discipline and the Use of Stock Market Data to Predict Bank Financial Distress, *Journal of Financial Services Research*, 30: 151–176.

Doherty, N. A., A. Kartasheva, and R. D. Phillips, 2008, Competition Among Rating Agencies and Information Disclosure, Working Paper, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1101700.

Eling, M., H. Schmeiser, and J. T. Schmit, 2007, The Solvency II Process: Overview and Critical Analysis, *Risk Management & Insurance Review*, 10(1): 69–85.

Epermanis, K., and S. Harrington, 2006, Market Discipline in Property/Casualty Insurance: Evidence from Premium Growth Surrounding Changes in Financial Strength Ratings, *Journal of Money, Credit, and Banking*, 38(6): 1515–1544.

European Commission, 2007, Directive of the European Parliament and the Council on the Taking-Up and Pursuit of the Business of Insurance and Reinsurance—Solvency II, (COM(2007) 361), Brussels.

Fenn, G. W., and R. A. Cole, 1994, Announcements of Asset-Quality Problems and Contagion Effects in the Life Insurance Industry, *Journal of Financial Economics*, 35: 181–198.

Flannery, M. J., 1998, Using Market Information in Prudential Bank Supervision:A Review of the U.S. Empirical Evidence, *Journal of Money, Credit, and Banking*, 30: 273–305.

Flannery, M. J., 2001, The Faces of "Market Discipline," *Journal of Financial Services Research*, 20(2/3): 107–119.

Harrington, S. E., P. M. Danzon, and A. J. Epstein, 2008, "Crises" in Medical Malpractice Insurance: Evidence of Excessive Price-Cutting in the Preceding Soft Market, *Journal of Banking & Finance*, 32(1): 157–169.

Hong, H., T. Lim, and J. C. Stein, 2000, Bad News Travels Slowly: Size, Analyst Coverage, and the Profitability of Momentum Strategies, *Journal of Finance*, 55(1): 265–295.

Insurance Council of New Zealand, 2008, Insurance Regulation, www.icnz.org.nz.

Jensen, M. C., and W. H. Meckling, 1976, Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure, *Journal of Financial Economics*, 3: 306–360.

King, T. B., 2008, Discipline and Liquidity in the Interbank Market, *Journal of Money, Credit, and Banking*, 40(2-3): 295–317.

Lee, S., D. Mayers, and C. Smith, 1997, Guaranty Funds and Risk-Taking: Evidence from the Insurance Industry, *Journal of Financial Economics*, 44: 3–24.

Linder, U., and V. Ronkainen, 2004, Solvency II—Towards a New Insurance Supervisory System in the EU, *Scandinavian Actuarial Journal*, 104(6): 462–474.

Liu, Q., K. Epermanis, and L. Cox, 2005, Agency Conflicts and Market Discipline: Evidence from Guaranteed Investment Contracts, http://www.fma.org/SLC/Papers/Liu_AgencyConflictsMarketDiscipline.pdf.

OECD, 2007, OECD Insurance Statistics, Organisation for Economic Co-operation and Development, Paris, www.oecd.org.

Peria, M., M. Soledad, and S. L. Schmukler, 2001, Do Depositors Punish Banks for Bad Behavior? Market Discipline, Deposit Insurance, and Banking Crises, *Journal of Finance*, 56: 1029–51.

Phillips, R. D., J. D. Cummins, and F. Allen, 1998, Financial Pricing in the Multiple-line Insurance Company, *Journal of Risk and Insurance*, 65: 597–636.

Pottier, S., and D. Sommer, 2002, The Effectiveness of Public and Private Sector Summary Risk Measures in Predicting Insurer Insolvencies, *Journal of Financial Services Research*, 21(1): 101–116.

Santomero, A. M., 1997, Commercial Bank Risk Management: An Analysis of the Process, *Journal of Financial Services Research*, 12(2–3): 83–115.

Schmitz, P., 2007, Market and Individual Investor Reactions to Corporate News in the Media, http://ssrn.com/abstract=1004488.

Sironi, A., 2003, Testing for Market Discipline in the European Banking Industry: Evidence from Subordinated Debt Issues, *Journal of Money, Credit, and Banking*, 35(3): 443–472.

Sommer, D. W., 1996, The Impact of Firm Risk on Property-Liability Insurance Prices, *Journal of Risk and Insurance*, 63: 501–514.

Standard & Poor's, 2007, Standard & Poor's Ratings Definitions, http://www2.standardandpoors.com/portal/site/sp/en/eu/page.article/2,1,5,0,1148442391999.html.

Yu, T., B. Lin, H. R. Oppenheimer, and X. Chen, 2006, Intangible Assets, Going-for-Broke and Asset Risk Taking of Property and Liability Insurance Firms, http://ssrn.com/abstract=923653.

Zanjani, G., 2002, Market Discipline and Government Guarantees in Life Insurance, Working Paper, Federal Reserve Bank of New York.