Corporate Demand for Insurance:
Empirical Evidence from Germany

Simone Krummaker

J.-Matthias Graf von der Schulenburg

Gottfried Wilhelm Leibniz University of Hannover
Institute for Insurance Economics
Koenigsworther Platz 1, 30167 Hannover, Germany
Phone +49 511 762 3495, Fax +49 511 762 5081
eMail sk@ivbl.uni-hannover.de

First Draft: August 20, 2007
Second Draft: December 10, 2007

Preliminary version, comments welcome
Please do not cite or quote without the authors' permission

Keywords: insurance demand, risk management, ownership structure, firm size, risk averse stakeholder, empirical evidence

JEL Classification: G22, G32, D21

1. INTRODUCTION

Risk taking and entrepreneurship always was and is closely connected. New businesses, products or services, and innovations are only possible by taking risk by the entrepreneur or financiers. Insurance is one of the most important instruments to transfer risk and therefore it helps to make risk manageable or affordable for firms and their owners.

As corporations do not behave similar to individuals the motivation to purchase insurance is different and risk aversion cannot explain the demand for insurance of widely held corporations. The owners of publicly traded companies can easily eliminate the specific/unsystematic risks, inherent in firms and markets, by diversifying their stock portfolios. Therefore risk management or buying insurance contracts in order to eliminate firm specific risk is redundant and moreover it does not increase the value of the firm for the investor/owner. In contrast it minimizes the value of the firm and its returns by paying insurance premiums (Knight 1921, Main 1982).

But it is obvious that the presence of risk causes costs for a firm and that the reduction of risk can create value (Doherty 2000). Major parts of the total property and liability premium income are paid by corporations (Main 1983 p. 198). Germany is the world's third largest market for non-life insurance (OECD 2003). The demand for corporate insurance is a very important factor for German insurance companies considering that in Germany 46.8 percent of the property insurance premiums written in 2005 (47.8% in 2004, 6.74 bn Euro) were paid by corporations (GDV (2006), p. 115, Krummaker/Hagemann (2006), pp. 37-39, Krummaker/Schulenburg 2006, p. 13).

As the basic assumption of risk aversion for individual insurance demand is not adequate for the corporate motivation to purchase insurance contracts several researchers have developed theories to explain this corporate risk management behaviour. The reasons for corporate demand for insurance therefore can be derived from information asymmetries and agency conflicts, transaction and bankruptcy costs, optimisation of taxes, the regulatory background of the company, efficient allocation of risk and the insurers comparative advantage in risk and loss related services. (e.g. Main 1982 and 1983, Mayers/Smith 1982 and 1987, MacMinn 1987, Stulz 1984, Skogh 1989).

Several studies analysed the corporate demand for insurance empirically, focussing on insurance markets in the United States (Mayers/Smith 1990, Garven/Lamm-Tennant 1997, Hoyt/Khang 2000; Browne/Hoyt 2000, Cole/McCullough 2006), Canada (Core 1997), Japan (Yamori 1999) and China (Zou/Adams/Buckle 2003). Surprisingly studies from Europe are missing (except Thomann/Schulenburg 2006, analysing the German market for terrorism insurance) although as an aggregate it is one of the most important and largest insurance markets. As a single market the German insurance market is one of the largest in Europe as well as worldwide. Focussing on corporate insurance supply Germany plays a dominant role as a large number of the most important corporate insurance companies and some of the biggest reinsurance companies are located there.

In our paper we examine the corporate demand for insurance in Germany. Therefore we analyse data from a German insurance company regarding property insurance contracts their customers. In this article we firstly will develop some hypotheses regarding corporate insurance demand that are guiding the empirical analysis. In a second step we present the data and sample we were able to obtain and the used variables in order to test the developed hypotheses. On this basis the results are conducted and then discussed. The paper ends with a conclusion and an outlook on further research.

2. CORPORATE RISK MANAGEMENT AND INSURANCE DEMAND

Following modern financial theory and theory of the firm companies can be seen as a set of several interdependent contracts (Jensen/Meckling 1976). Since those companies do not have an own risk attitude, the preference towards risk arises out of the risk preferences of the stakeholders. Fama and Jensen argue that the interests of residual claimants and particularly of the owners are decisive for the decisions within the firm as they bear the risk (Fama/Jensen 1983). Assuming perfect markets they are able to hold a diversified portfolio which eliminates the insurable risk (Mayers/Smith 1982 p. 282). Therefore corporate risk management and the purchase of insurance contracts are not in the interest of the stock holders, as this reduces the owners revenues by paying insurance premiums or buying other risk management instruments. But the existence of risk in a firm causes costs, considering risk averse stakeholders, transaction costs, bankruptcy costs, agency conflicts between managers and owners as well as between bondholders and stockholders, regulation of labour markets and imperfect (capital-)markets. Although companies are not primarily

risk averse those restrictions lead to the fact that companies behave as if they were risk averse.

In this paper we aim to test the above mentioned theoretical hypotheses concerning reasons for corporate insurance demand developed by several researchers and partially tested in previous studies. As those hypotheses are neither tested for any European nor German market we are able to find evidence.

Ownership Structure

Mayers and Smith find three important functions of the ownership structure (Mayers/Smith 1988):

- the managerial function – managers as decision makers,
- the ownership/risk bearing function – the owner provides capital and claims to the risky income stream of the firm,
- the customer function – the customer pays for a service or product and expects to receive an equivalent.

The ownership structure, the diversification of owners and stakeholders and the connected risk shift is relevant for the insurance demand. In individual enterprises the manager typically is also the owner, the owner bears risk also with his personal wealth. In this case we assume that the insurance purchasing behaviour can sufficiently be explained by risk aversion (Mayers/Smith 1982, p. 293, Doherty/ Smith 1993, p. 5). In contrast to stock corporations we expect that these individual enterprises buy more insurance than stock corporations where the stockholder only bears risk according to the amount of his share.

Size, Bankruptcy Costs and Real Services

The first reason, why size plays an important role on the demand for corporate insurance are bankruptcy costs. These can be minimised via risk management. As the transaction costs of bankruptcy are less than proportional to firm size small firms bear a greater amount of these costs. Therefore they are more likely to purchase insurance in order to reduce the probability of incurring these costs than larger firms (Mayers/Smith 1992, p. 284).

Secondly, insurance companies have comparative advantages in processing claims and loss prevention and claims administration. Corporations with insurance contracts can benefit from the insurers activities connected with loss prevention, risk assessment and claims settlement (Mayers/Smith 1982, p. 285-286). Besides the risk transfer on of the main reasons to buy insurance is to take advantage from the insurers real services (Doherty/Smith 1993).This expertise provides more motivation to smaller than larger companies since they have less resources and experience in risk management.

Regulation

Mayers and Smith state that the regulation of industries has an influence on the demand for corporate insurance. Furthermore regulated companies are able to shift premiums resp. loadings on premiums from the firm's owners to customers. Therefore regulated companies would purchase more insurance than unregulated firms (Mayers/Smith 1982, p. 292).

Taxes

Under the condition of a convex tax function and limited loss carry forwards, the purchase of insurance can reduce the expected tax liability. On the one hand, insurance premiums are deductible business expenses, on the other hand the annual fluctuation of profits and therefore tax liabilities can be smoothened by replacing property or liabilitiy losses with insurance premiums (Mayers/Smith 1982 pp. 289-291, MacMinn 1987).

Since German companies are facing linear corporate taxes we will not focus on this aspect in the empirical investigation.

Agency Conflicts

Two main agency conflicts are discovered in a corporate environment: the conflict of interest between owners and managers and the conflict between interests of debtholders and equityholders.

The conflict between owners and managers arises out of the different risk preferences resp. out of the fact, that on the one side the owner as a shareholder is able to diversify risk and therefore is not interested in the firm's risk management. On the other hand the manager's human capital is limited to diversification, his wealth is connected with the company's success. That is why managers are interested in risk management and insurance demand

(Jensen/Meckling 1976). So companies with greater discretion for managers will purchase more insurance contracts.

Conflicts between shareholders and debtholders in leveraged firms lead to problems as the underinvestment problem or asset substitution. On the one hand the equityholders are interested in increasing the risk of the firm in order to increase the value of the equity on the expense of the debtholder. On the other hand the benefits of investments mostly accrue to the bondholders the shareholders might not be interested in undertaking these investments as they have to bear the risks. The purchase of insurance is more likely for firms with higher leverage (Myers 1977, Mayers/Smith 1982 and 1987).

Risk Bearing

Contracting in organisations causes transaction costs that as a consequence it is efficient to allocate risks to those claimholders of a corporation who have a comparative advantage in risk bearing. In contrast to equityholders and debtholders claimholders as employees, suppliers, customers and managers are not able to diversify risks and for this reason they take the level of uncertainty of their payments into account. Shifting the risk bearing to claimholders of debt and equity is less costly but limited by the capital stock of the company. Via insurance the company is able to transfer risk to the insurer, which leads to an efficient risk allocation. Furthermore, the reduction of the possible risk fee of the claimholders may cover the loading fees of the insurance contract. As a result and according to Mayers and Smith it is expected that companies with a higher proportion of risk averse claimholders as employees, suppliers etc., to the company's outcome, will demand more insurance.

In the following section we will present the sample of companies and insurance date as well as the specific variables we develop to test modified hypotheses.

3. DATA DESCRIPTION AND VARIABLES

As public information is not available on the corporate demand for insurance, we received data from a large German insurance company. The dataset covers German companies insured in the years 2004 and 2005. The sample includes 3673 German companies from different industries with property (fire) and all risk insurance, business interruption insurance (all risk and fire), business liability insurance and environmental pollution insurance. Connected with these classes of insurance we have information on the premiums written 2004

and 2005, number and amount of losses/indemnities, sums insured, maximum annual compensation and probable maximum loss. Moreover the dataset includes the industrial sector of the company, the legal form, the amount of annual turnover and number of employees. Table 1 shows the industries and number of companies in the sample.

Table 1: Industries and number of companies in the sample

Industry	Number of companies	%
Retail Automobile	1947	53.0
Services	241	6.6
Wholesale	181	4.9
Construction	162	4.4
Engineering	149	4.1
Metal	148	4.0
Retail	124	3.4
Real Estate, Property	69	1.9
Food, Textiles	61	1.7
Furniture, Wood	54	1.5
Mining	37	1.0
Chemical Industry	37	1.0
Energy, Water	33	0.9
Transport	33	0.9
IT, Software	28	0.8
Paper	21	0.6
Hotels and Restaurants	19	0.5
Automobile	15	0.4
Agriculture	15	0.4
Waste, Sewage, Recycling	14	0.4
Health	14	0.4
Insurance	8	0.2
Banking	7	0.2
Petroleum	3	0.1
Other	253	6.9
Total	3673	100

Insurance Demand

In this paper we aim to find determinants which explain the corporate demand for insurance which we measure as level of coverage, which is implicitly chosen by the company as the ratio of the annual maximum compensation to the the value of insured assets total sum

insured in the property insurance. Table 2 shows the summary statistics on the corporate demand for insurance. 99.15 percent have chosen full coverage.

Table 2: Corporate demand for insurance

Moments		Percentiles	
Mean	0,9915	5%	0,9047
Std. Dev.	0,3520	10%	1
Skewness	12,0159	25%	1
Kurtosis	227,9676	50%	1
Median	1	75%	1
Minimum	0,0034	90%	1
Maximum	9,4568		
N	3110		

Corporate demand for insurance: level of coverage = annual maximum compensation / total sum insured

Size

We expect that smaller firms insure more than larger firms, which implies a negative correlation between firm size and insurance demand. The variable SIZE is represented by the annual turnover of the company.

Table 3: Size of the companies in the sample

Class	Turnover in thsd. Euro	Number of Companies	%
1	0 - 250	1385	37.7
2	251 - 500	122	3.3
3	501 - 750	115	3.1
4	751 - 1 000	112	3.0
5	1 001 - 2 000	314	8.5
6	2 001 - 2 500	104	2.8
7	2 501 - 5 000	367	10.0
8	5 001 - 7 500	237	6.5
9	7 501 - 10 000	168	4.6
10	10 001 - 20 000	322	8.8
11	20 001 - 30 000	144	3.9
12	30 001 - 40 000	56	1.5
13	40 001 - 50 001	43	1.2
14	50 001 - 100 000	87	2.4
15	100 001 - 250 000	53	1.4
16	250 001 - 750 000	25	0.7
17	> 750 000	19	0.5
Total		3673	100

Ownership structure

The ownership structure of a company is represented by its legal form. We distinguish stock companies, individual enterprises and corporations with limited liability. For each form a dummy variable, STOCK, INDIVIDUAL and LIMITED is created with 1 when legal form is true and 0 otherwise.

Table 4: Ownership structure as legal form of the company

legal form	Number of Companies	%
public stock company	65	1.77
limited liability company	2185	59.49
closely held company	1205	32.81
other	218	5.94
Total	3673	100

Regulation

We argue that higher regulated industries might purchase more insurance than less regulated industries. Regulation of businesses can focus on four categories:

- Price regulation
- Public supply of goods and services
- Barriers to entry the market
- Contract regulation

We declared an industry as regulated when two of those categories apply to an industry. Those industries were marked with a dummy variable REGULATION, which is 1 for companies belonging to a regulated sector and 0 otherwise.

Risk bearing

As we expect that companies with a higher proportion of risk averse claimholders as employees to the company's outcome, will demand more insurance, we measure this with the variable TURNOVER-EMPLOYEE-RATIO. Therefore we divide the classes of turnover with the classes of numbers of employees.

The following table shows the summary statistics and definition of the variables.

Table 5: Summary Statistics

Variable	Definition		N	Mean	Standard Deviation	Minimum	Maximum
Insurance demand	level of coverage = Annual Maximum Indemnity / Sum Insured Property Insurance		3110	0,99148	0,35199	0,00342	9,45679
Size	annual turnover measured in 17 classes		3110	6,86270	4,95851	1	17
Relative premiums	property insurance premiums / property insurance sum	2004	1385	0,00046	0,00069	0	0,01368
		2005	1605	0,00042	0,00061	0	0,01058
Premium-loss-ratio	Losses property insurance/ premiums property insurance	2004	666	10,52322	80,81571	0,00007	1527,51404
		2005	691	4,79979	17,00518	0,00313	258,54830
Regulation	Dummy variable = 1 if regulated industry		3110	0,05016	0,21831	0	1
Ownership structure	stock company - Dummy variable = 1		3110	0,07717	0,26690	0	1
	individual enterprise - Dummy variable = 1		3110	0,20932	0,40689	0	1
Turnover-employee-ratio	turnover classes / employee classes		3110	2,34220	1,78555	0,10000	17,00000
Sum Insured	property insurance sum		3110	71.602.997,2	298.309.106,8	0	4.774.810.111,0
Losses	indemnity payments	2004	3110	7.726,3	272.342,5	0	15.120.000,0
		2005	3110	8.379,8	126.926,0	0	4.890.107,5
Number of Losses	number of losses for property insurance contracts	2004	3110	0,47460	1,42322	0	31
		2005	3110	0,52347	1,81801	0	51

4. RESULTS AND DISCUSSION

The sample consists only of insured firms, hence we test the arguments concerning the corporate insurance demand on basis of a tobit regression model. The results are shown in table 6.

Table 6: Regression model on corporate insurance demand

	A			B			C w/o car dealer		
degree of coverage	**Coef.**	**t**		**Coef.**	**t**		**Coef.**	**t**	
turnover	-.0031	-2.23	**	.0036	2.96	***	-.0046	-2.01	**
turnover-employee-ratio	-.0037	-1.06		-.0041	-1.10		-.0058	-1.07	
stock company	-.0519	-2.11	**	.0245	.-6.13	***	-.0539	-1.54	
individual enterprise	-.0044	-0.28		.0110	0.90		-.0075	-0.21	
regulation	-.0008	-0.03		.0602	2.09	**	.0005	0.01	
premium-loss-ratio				-.0021	-7.42	***			
cons	1.027	78.53	***	.9738	87.96	***	1.043	42.39	***
Number of obs	3110			691			1651		
LR chi2(5)	13.93			93.45			8.96		
Prob > chi2	0.016			0.000			0.110		
Log likelihood	-1158.096			423.889			-1136.325		
Pseudo R2	0.006			-0.123			0.003		

*** significant on .01 level, ** significant on .05 level, *significant on .10 level

The results of the tobit regression concerning the variable for size, turnover/revenues, are not clear. The regression models A and C show a significant negative influence of size on the demand for insurance, what goes along with our hypothesis. Interestingly the model C shows a significant positive sign, when the premium-loss-ratio is added. This can be considered as rational, because firms with a higher amount of losses, in comparison with the insurance premiums, demand a higher level of coverage. If large companies have also more power on the insurance market, they may be more effective in negotiating low premiums per risk. That might be one reason for our result, that large firms buy more insurance than small firms.

The variables to measure the ownership structure with the legal form of the company are not totally consistent with our hypothesis. As stock companies significantly purchase less insurance than other legal forms, the dummy variable for individual enterprises also shows a negative sign.

The regression results show also that regulation of industries stimulates regulated companies to demand more insurance than unregulated businesses.

We found strong evidence that with a higher proportion of employees on the annual turnover, the demand for insurance increases. (the coefficient is negative as the ratio of turnover to employees gets smaller with a higher amount of employees). This supports the hypothesis that a larger fraction of risk averse stakeholders relative to outcome takes this risk aversion into account. This may be due to job protection laws and so on in Germany, which cause higher cost on firms.

Limitations

This study of corporate insurance demand is subject to sample selection bias, as only insured companies are in the sample. We also do not know the actual price paid for insurance coverage. The sample, containing 53% car dealers, does not represent the industry distribution in Germany.

5. CONCLUSION

The purpose of this paper was to find empirical evidence from German companies supporting the well known hypotheses concerning corporate insurance demand. As several studies previously analysed the insurance purchase behaviour of firms we had to state that those mostly were based on American and Asian data. With this paper we are able, to fill the gap of European and especially German evidence.

6. REFERENCES

Browne, Mark J. and Robert E. Hoyt, 2000. The Demand for Flood Insurance: Empirical Evidence, *Journal of Risk and Uncertainty*, Vol. 20, pp. 291-306

Cole, Cassandra R. and Kathleen A. McCullough, 2006. A Reexamination of the Corporate Demand for Reinsurance, *Journal of Risk and Insurance*, Vol. 73, No. 1, pp. 169–192.

Core, John E., 1997. On the Corporate Demand for Directors' and Officers' Insurance, *Journal of Risk and Insurance*, Vol. 64, No. 1, pp. 63-87.

Doherty, Neil A., 2000. Integrated Risk Management. Techniques and Strategies for Reducing Risk, New York et al.

Doherty, Neil A. and Smith

Fama, Eugene F. and Michael C. Jensen, 1983. Separation of Ownership and Control, *Journal of Law and Economics*, Vol. 26, No. 2, pp. 301-325.

Garven, James R. and Joan Lamm-Tennant, 1997. The Demand for Reinsurance: Theory and Empirical Tests. Working Paper. Louisiana State University/ GenRe.

GDV 2006. Gesamtverband der Deutschen Versicherungswirtschaft e.V., Jahrbuch 2006 – Die deutsche Versicherungswirtschaft

Hagemann, Reiner and Simone Krummaker, 2007. Die Entwicklung des Firmengeschäfts in Deutschland; in: Krummaker, Simone und J.-Matthias Graf von der Schulenburg (Hrsg.), The Rise of Risk Management – The Fall of Corporate Insurance?, Karlsruhe, pp. 35-48.

Hoyt, Robert E. and Ho Khang, 2000. On the Demand for Corporate Property Insurance, *Journal of Risk and Insurance*, Vol. 67, No. 1, pp. 91-107.

Jensen, Michael C. and William H. Meckling 1976. Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure, *Journal of Financial Economics*, Vol. 3, pp. 305-360.

Krummaker, Simone and J.-Matthias Graf von der Schulenburg, 2006. The Rise of Risk Management – The Fall of Corporate Insurance, in: Krummaker, Simone und J.-Matthias Graf von der Schulenburg (Hrsg.), The Rise of Risk Management – The Fall of Corporate Insurance?, Karlsruhe, pp. 1-17.

MacMinn, Richard, 1987. Insurance and Corporate Risk Management, *Journal of Risk and Insurance,* Vol. 54, pp. 658-677.

Main, Brian G. 1982. The Firm's Insurance Decision. Some Questions Raised by the Capital Asset Pricing Model, *Managerial and Decision Economics*, Vol. 3, pp. 7-15

Main, Brian G. 1983. Corporate Insurance Purchases and Taxes, *Journal of Risk and Insurance*, Vol 50, pp. 197-223.

Mayers, David and Clifford W. Smith, 1982. On the Corporate Demand for Insurance, *Journal of Business*, Vol. 55, pp. 281-296.

Mayers, David and Clifford W. Smith, 1987. Corporate Insurance and the Underinvestment Problem, *Journal of Risk and Insurance*, Vol. 54, pp. 45-54.

Mayers, David and Clifford W. Smith, 1988. Ownership Structure Across Lines of Property-Casualty Insurance, *Journal of Law and Economics*, Vol. 31, pp. 351-378.

Mayers, David and Clifford W. Smith, 1990. On the Corporate Demand for Insurance: Evidence from the Reinsurance Market, *Journal of Business*, Vol. 63, pp. 19-40.

Myers, Stewart, 1977. Determinants of corporate borrowing. *Journal of Financial Economics*, Vol. 5, No. 2, pp. 147-175.

OECD 2003. Insurance Statistics Yearbook 1994-2001, Paris 2003.

Thomann, Christian and J.-Matthias Graf von der Schulenburg, 2006. Supply and Demand for Terrorism Insurance: Lessons from Germany, Discussion Paper No. 340, Gottfried Wilhelm Leibniz University of Hannover, http://www.wiwi.uni-hannover.de/Forschung/Diskussionspapiere/dp-340.pdf.

Yamori, Nobuyoshi, 1999. An Empirical Investigation of the Japanese Corporate Demand for Insurance, *Journal of Risk and Insurance*, Vol. 66, No. 2, pp. 239-252.

Zou, Hong, Mike B. Adams and Mike J. Buckle, 2003. Corporate Risks and Property Insurance: Evidence from the People's Republic of China, *Journal of Risk and Insurance*, Vol. 70, No. 2, pp. 289-314.