CORPORATE DEMAND FOR INSURANCE:
EMPIRICAL EVIDENCE FROM GERMANY

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Abstract

Several studies have tested theoretical arguments for corporate insurance purchasing behaviour with mixed evidence. Additionally, there are rarely studies focussing on European markets even though these belong to the largest markets for commercial insurance and reinsurance. This paper presents the first empirical analysis on the property insurance demand in Germany using a dataset of 2160 companies. The analysis suggests that the demand for insurance is influenced by the firm's size and its ownership structure. Additionally, higher premium payments lead to a lower demand for insurance whereas the number of insurance contracts is positively associated with the insurance demand. No clear evidence was found for the loss-ration or the number of losses. This study also sheds light on the importance of the supply side and the design of the insurance contract for the demand of insurance.

Key Words: corporate insurance demand, property insurance, risk management
JEL classification: G22, D81,

1   Introduction

Firm's demand for insurance so far cannot be derived from a coherent theoretical approach. Additionally, the concept of risk aversion as a fundament for individual decision making and insurance demand cannot be transferred on organisations. Since the 1980s several researchers have derived theoretical factors explaining corporate risk management and insurance demanding behaviour (e.g. Main, 1982; Main, 1983; Mayers and Smith, 1982; Mayers and Smith, 1987; MacMinn, 1987; Stulz, 1984; Skogh, 1989). According to their research, the corporate demand for insurance can be derived from information asymmetries and agency conflicts, transaction and insolvency costs, tax optimisation strategies, the regulatory background of the company, efficient allocation of risk and the insurer's comparative advantage in risk and loss related services.

Following the development of theoretical factors, since the 1990s several studies have analysed the corporate demand for insurance empirically, focussing on insurance markets in the United States (Mayers and Smith, 1990; Garven and Lamm-Tennant, 1997; Hoyt and Khang, 2000; Browne and Hoyt, 2000; Cole and McCullough, 2006; Aunon-Nerin and Ehling, 2008; Michel-Kerjan, Raschky and Kunreuther, 2014), Canada (Core, 1997), Japan (Yamori, 1999), China (Zou, Adams and Buckle, 2003) and Korea (Regan and Hur, 2007). Surprisingly studies from Europe are missing although it is one of the most important and largest insurance markets.[1] As a single market the German insurance market is one of the largest in Europe as well as worldwide (OECD 2012). Focussing on commercial insurance supply, Germany plays a dominant role as a large number of commercial insurance companies and some of the biggest reinsurance companies are located there. Germany is the world's second largest market for non-life insurance (OECD 2012) and the demand for corporate insurance is a very important factor for German insurance companies considering that ca. 47 percent of the German property insurance premiums written in 2011 were paid by firms (GDV 2012).[2] The lack of empirical studies for Europe and Germany in particular might be due to very limited data availability, as companies usually are not obliged to disclose insurance coverage data.

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[1] Exemptions are Thomann and Schulenburg (2006) analysing the German market for terrorism insurance and Reißaus (2006) focusing on reinsurance

[2] The proportion of premiums paid by companies for property insurance remained relatively stable in the last years.

A series of empirical studies has aimed at finding evidence to support the theories on corporate insurance demand. Until now only very studies have focused on European insurance markets (Thomann and Schulenburg, 2006 and Reißaus, 2006), even though here are some of the largest insurance markets for commercial insurance in the world. This study therefore aims at testing the theories on the German market to be able to add empirical evidence to the theories developed.

This paper examines firm's demand for property insurance in Germany by analysing a data set provided by a German commercial insurance company. The findings from this study show the impact of company size on the insurance demand. It can also be observed that publicly listed companies demand less insurance than companies with other legal forms. Another important result is that the premiums paid by companies have a negative relationship to the insurance demand, suggesting, that companies adjust their level of insurance coverage subject to the amount of premiums paid. Furthermore, this study also provides evidence that the existing approaches on firms' insurance demand might have a gap regarding the supply side of the insurance market. So far I am only aware of one paper explicitly taking the supply side into account (Michel-Kerjan, Raschky and Kunreuther, 2014).

This paper contributes to corporate risk management literature by adding an empirical study which focuses on an important insurance market which the existing literature so far has neglected. Additionally, this study is able to go beyond corporate insurance demand as our sample also consists widely of other legal forms than listed corporations. The study also broadens the literature on the firms' insurance demand as some new factors, such as the premiums, show an impact. The paper further benefits from the unique company dataset, as I was able to access from a large German insurance company regarding property insurance contracts with more than 2100 companies in the sample.

In this article I firstly will review the existing literature and theory before the hypotheses regarding corporate insurance demand are developed that are guiding the empirical analysis. In next step I present the data and sample I was 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

According to modern financial theories and theories of the firm a company's risk management behaviour follows the risk preferences of the owners as they bear the firm's risk (Jensen and Meckling, 1976; Fama and Jensen, 1983). Assuming perfect markets they are able to hold a well-diversified portfolio, which eliminates the insurable risk (Mayers and Smith, 1982 p. 282). As a consequence, risk management and the purchase of insurance contracts are not consistent with the owners' interest, as e.g. paying insurance premiums reduces their revenues. But leaving the assumption of perfect markets, the existence of risk is costly for a company resulting in comprehensive demand for insurance. Several theories have been developed to explain firm insurance purchasing behaviour, starting with Mayers' and Smith's seminal paper in 1982. Moreover, insurance can also be seen as a means of financing. Transferring insurable risks to an insurance company releases financial resources to cover other entrepreneurial or market risks which cannot easily be mitigated or transferred.

The following paragraphs give an overview over the theories utilized to explain what influences the demand for insurance of firms and empirical findings.

Risk shifting and transaction costs

Broadly discussed motives for firm's insurance demand can be found in risk shifting and transaction costs. Risk shifting is discussed in connection with the legal form resp. ownership structure of the company. Managerial discretion differs over various legal forms of companies. The legal form in general determines the ownership structure of the firm. Mayers and Smith (1988) exemplify three important functions of the ownership structure: (1) the managerial function: managers as decision makers, (2) the ownership and risk bearing function: the owner provides capital and claims to the risky income stream of the firm, (3) 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 such as sole proprietorships the relevant decision maker typically is also the owner, the owner bears risk also with his personal wealth. In this case it can be assumed that the insurance purchasing behaviour can sufficiently be explained by risk aversion (Mayers and Smith, 1982; Doherty and Smith, 1993). In contrast to publicly traded firms individual enterprises buy more insurance than stock corporations where the owner only bears risk according to the amount of his share.

Considering all empirical tests on the ownership structure, mixed results can be stated. There are both, studies indicating to an influence of the ownership structure on corporate insurance demand (e.g. Mayers and Smith, 1999; Regan and Hur, 2007; Cole and McCullough, 2007) and studies indicating to no influence or an unclear relationship (Zou, Adams and Buckle, 2003; Yamori, 1999).

Hedging or the purchase of insurance can support the reduction of revenue volatility and therefore reduce the probability of insolvency (Smith and Stulz, 1985; Froot, Scharfstein and Stein, 1993) as well as the reduction of direct and indirect bankruptcy costs, which will also occur if the company is rescued after solvency problems. (Mayers and Smith, 1982; Main, 1982). Besides the direct costs, such as legal and administrative fees, a company always faces indirect costs of a potential insolvency. These include for example the loss of reputation and following this also of market share or financing sources, increasing financing costs and risk premiums by investors or potential managers. Additionally, indirect costs of a financially stressed company might lead to or worsen agency conflicts (Warner, 1977; Grillet, 1992; Doherty and Smith, 1993). The transaction costs of bankruptcy are expected to be less than proportional to firm size, thus, small firms bear a greater amount of these costs. Therefore, they benefit more from demanding insurance in order to reduce the probability of incurring these costs than larger firms (Mayers and Smith, 1992). This hypothesis is also supported empirically by e.g. Aunon-Nerin and Ehling (2008) or Core (1997) whereas Hoyt and Khang (2000) had mixed results.

Under the existence of transaction cost it is efficient to allocate risks to those stakeholders of a company who have a comparative advantage in risk bearing. In contrast to equityholders and debtholders stakeholders as employees, managers or suppliers 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 (Mayers and Smith, 1982; Eeckhoudt, Gollier and Schlesinger, 2005). Insurance enables the company to transfer risk to the insurer which leads to an efficient risk allocation (Eeckhoudt, Gollier and Schlesinger, 2005). Furthermore, the reduction of the potential risk premium of stakeholders may cover the loading fees of the insurance contract. As a result and according to Mayers and Smith (1982) it is expected that companies with a higher proportion of risk averse stakeholders to the company's outcome, will demand more insurance.

Moreover, insurance companies have comparative advantages in evaluation risks, loss prevention and processing claims. Companies with insurance contracts can benefit from these insurers activities and services which are connected with the transfer of an insurable risk. Beyond risk transfer, one of the main reasons to buy insurance is to take advantage from the insurer's real services (Mayers and Smith, 1982; Doherty and Smith, 1993; Doherty, 2000).This expertise provides more motivation to smaller than larger companies since they have less resources and experience in risk management.

The argument, that size plays an important role for the demand of company's insurance demand due to bankruptcy cost and insurers services was tested by several studies. The reasons for this behaviour might be also driven by better diversification opportunities e.g in terms of geographical diversification or different lines of business, or more developed internal risk management processes for larger firms. Additionally, larger companies might find easier access to finance from diverse sources and could also easier organise self-insurance or generate internal funds. Furthermore, real services from insurance companies seem to be even more beneficial for smaller firms (Doherty, 2000; Hau, 2006). Although contradicting results are found by two studies (Hoyt and Khang, 2000; Regan and Hur, 2007) and Core (1997) finds that company size does not influence the purchasing behaviour for D&O insurance in Canada, most other empirical studies have found that larger

companies demand less insurance than small companies (e.g. Mayers and Smith, 1990; Yamori, 1999; Hoyt and Khang, 2000; Zou, Adams and Buckle, 2003; Cole and McCullough, 2006; Michel-Kerjan, Raschky and Kunreuther, 2014). Hoyt and Khang (2000) additionally have found empirical evidence that the services of an insurance company which are connected to the risk transfer drive the demand for insurance. But other studies have not found this influence or have not tested it.

Agency conflicts

Another main motive for firm's insurance demand can be explained with agency theory. Two main agency conflicts are discovered in a firms' environment: the conflict of interest between owners and managers and the conflict between interests of debtholders and equityholders. Conflicts between equityholders such as shareholders and debtholders, e.g. banks or bondholders, in leveraged firms lead to problems such as the underinvestment problem or asset substitution. Under the risk of insolvency situations might arise, where equityholders are interested in increasing the risk of the firm in order to increase the value of the equity on the expense of the debtholders. On the other hand side the benefits of value increasing investments in this situation mostly accrue to the debtholders the shareholders might not be interested in undertaking these investments as they have to bear the risks (Myers, 1977; Mayers and Smith, 1987). The purchase of insurance is more likely for firms with higher leverage in order to alleviate these conflicts (Myers, 1977; Mayers and Smith, 1982; Mayers and Smith, 1987).

The conflict between owners and managers arises out of the different risk preferences resp. out of the fact that on the one hand side the corporate owners (as shareholders) are able to eliminate firm specific risk by diversification and therefore they are not interested in the firm's risk management. On the other hand side, the manager's human capital is limited to diversification; his/her wealth is connected with the company's success. That is why managers are interested in risk management and insurance demand (Jensen and Meckling, 1976). Thus, it is expected that companies with greater managerial discretion will purchase more insurance contracts as managers can use this to protect their own wealth and sphere.

There is one study giving empirical support for this theory (Hoyt and Khang, 2000). Zou, Adams and Buckle (2003) as well as Core (2007) found data indicating to the influence of managerial risk aversion on the demand for insurance. But most tests fail due to unavailable or improper data.

Regulation and Taxes

Mayers and Smith (1982) state that the regulation of industries has an influence on the demand for corporate insurance, as 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 and Smith, 1982). Contrarily, it can also be stated that companies in regulated industries exhibit a lower insolvency probability as legal requirements and monitoring would lead to a better solvency situation (e.g. Grillet, 1992). Therefore, the effect of insurance in lowering bankruptcy costs is smaller, hence decreasing the motivation to demand insurance. Both effects are supported empirically as Core (1997), Yamori (1999) and Regan and Hur (2007) found a positive influence of regulation on insurance demand whereas Hoyt and Khang (2000) found a negative relationship.

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 side, insurance premiums are deductible business expenses and on the other hand side the annual fluctuation of profits and therefore tax liabilities can be smoothened by replacing property or liability losses with insurance premiums (Mayers and Smith, 1982; MacMinn, 1987). Hoyt and Khang (2000) as well as Regan and Hur (2007) found empirical evidence for this influence of taxes on the demand for insurance. Other studies did not find this influence or could not test it (Yamori, 1999).

3   Data Description and Variables

Public information regarding the corporate demand for insurance is not available for Germany companies as these are not obliged to disclose insurance related data. Instead, the data for this study were provided by a large German insurance company with a long tradition in commercial insurance. The dataset covers German companies insured with this insurer in the years 2004 and

2005 and includes 2160 German companies with 3520 contracts. The insurance contracts covered in this sample are property (fire) and all risk insurance and business interruption insurance (all risk and fire). Additional data provided are premiums written for the years 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 annual turnover and the 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	Frequency	Percent	Cumulative
Automobile retail	1486	68.80	68.80
Other	100	4.63	73.43
Metal	88	4.07	77.50
Engineering	81	3.75	81.25
Wholesale	76	3.52	84.77
Services	62	2.87	87.64
Real Estate	38	1.76	89.40
Food & Textiles	37	1.71	91.11
Retail	23	1.06	92.18
Mining	23	1.06	93.24
Furniture & Wood	22	1.02	94.26
Paper	18	0.83	95.09
Construction	17	0.79	95.88
Chemicals	16	0.74	96.62
Energy & Water	16	0.74	97.36
IT & Software	14	0.65	98.01
Transport	10	0.46	98.47
Insurance	8	0.37	98.84
Automobile	6	0.28	99.12
Health	5	0.23	99.35
Waste, Recycling & Sewage	4	0.19	99.54
Banking	4	0.19	99.72
Hotels & Restaurants	2	0.09	99.81
Petroleum	2	0.09	99.91
Agriculture	2	0.09	100.00
Total	**2160**	**100**	

The type of industry is included as indicator variables into the analysis.

Insurance Demand

In this paper I aim at discovering determinants which drive firms' demand for insurance. To achieve this, insurance data provided by a specific insurance company are analysed.

The dependant variable "demand of insurance" is derived as degree of coverage purchased with the property insurance contract. I follow the approach of Hoyt and Khang (2000) as well as Zou, Adams and Buckle (2003) who construct the dependent variable to measure the insurance demand in relation to the insurable value of the company. The companies in this study actively decide about their annual maximum compensation with regard to the insurance sum. As the total sum insured reflects the value of insurable assets and the decision maker in the company negotiates with the insurer about the annual maximum compensation, this indicates how much insurance coverage is demanded. The insurance demand therefore is derived as "degree of coverage". The degree of coverage is measured as the ratio of the "annual maximum compensation" to the "total sum insured" in the property insurance contract. Table 2 shows the summary statistics on the corporate demand for insurance.

Table 2: Corporate demand for insurance

degree of coverage	Obs	Mean	Std. Dev.	Min	Max
all contracts	3520	0.9119	0.2487	0.0034	1
without Automible retailers	2018	0.8469	0.3124	0.0034	1
only Automobile retailers	1502	0.9994	0.0232	0.0997	1

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

The full sample contains 1486 automobile retailers which are offered a special insurance policy by the insurance company with full coverage as default choice (annual maximum compensation = total sum insured). As a result all automobile retailers in this sample, except one firm in one contract, have chosen full coverage, a degree of coverage of 1.0. Therefore, I have analysed the summary statistics for the degree of coverage excluding automobile retailers. We can see that the mean of the level of coverage is slightly lower with 84.69 percent. But also here we can state that the majority of companies chose full coverage contracts (1561 of 2018 contracts exhibit full coverage).

Size of the company

Different studies have used different approaches to measure the size of a company. A common practice is to use the total assets (e.g. Hoyt and Khang, 2000; Zou et al., 2003; Regan and Hur, 2007) or market capitalisation (e.g. Yamori 1999). The European Commission suggests defining the size of small and medium-sized enterprises by staff headcount, annual turnover or annual balance sheet and to meet at least two criteria; staff headcount with annual turnover or annual balance sheet (European Commission 2003). Additionally, press rankings of firms are also using annual turnover to determine the size of a firm, so for example the German Handelsblatt ranking of the 500 largest European companies (Sommer 2009).

In this study I follow the European Commission (2003), as the sample of companies is very diverse with respect to the industries they belong to. This means different approaches to measure firm size are appropriate for different types of industry. Assets or turnover might be valid for firms in the so called "old economy" but is perhaps not appropriate for the service industry. Tangible production factors play a secondary role for service firms as human resources are the most important factor there. Focussing on financial services such as insurance companies we see that size and business results might be measured via capital assets or annual premium income. These factors measure business volume and are related to measures like revenues but are hardly comparable with other businesses. The number of employees might be a comparable factor to approximate firm size as this factor is relatively stable and represents resource input. But considering the so called "new economy" the number of employees might be a misleading figure, as these firms are able to generate high turnovers with a relatively small amount of input factors. Here revenues or turnover might be appropriate criteria to compare firm sizes.

As annual turnover and the number of employees seem to be factors which reflect the size of a company over different industries best I will use both in this study. Table 3 gives an overview about the size indicators.

Table 3: Size of the companies in the sample

class	turnover	Frequency	Percent	class	employees	Frequency	Percent
1	0 - 250 000 Euro	714	33.06	1	0 to 9 employees	839	38.84
2	251 000 - 500 000 Euro	19	0.88	2	10 to 24	411	19.03
3	501 000 - 750 000 Euro	18	0.83	3	24 to 49	390	18.06
4	751 000 - 1 000 000 Euro	38	1.76	4	50 to 74	149	6.9
5	1 001 000 - 2 000 000 Euro	136	6.3	5	75 to 99	94	4.35
6	2 001 000 - 2 500 000 Euro	55	2.55	6	100 to 249	137	6.34
7	2 501 000 - 5 000 0000 Euro	246	11.39	7	250 to 499	74	3.43
8	5 001 000- 7 500 000 Euro	184	8.52	8	500 to 749	22	1.02
9	7 501 000 - 10 000 000 Euro	145	6.71	9	750 to 999	8	0.37
10	10 001 000 - 20 000 000 Euro	263	12.18	10	more than 1000	36	1.67
11	20 001 000 - 30 000 000 Euro	113	5.23				
12	30 001 000 - 40 000 000 Euro	40	1.85	**Total**		**2160**	**100**
13	40 001 000 - 50 001 000 Euro	35	1.62				
14	50 001 000 - 100 000 000 Euro	80	3.7				
15	100 001 000 - 250 000 000 Euro	38	1.76				
16	250 001 000 - 750 000 000 Euro	21	0.97				
17	> 750 000 000 Euro	15	0.69				
Total		**2160**	**100**				

As two indicators of size available, turnover and number of employees are available, the variable SIZE is created by combining the categories of turnover with the categories of employees (size = turnover + employees). This enables the analysis to capture the benefits of both measures.

According to theory discussed earlier I expect that smaller firms insure more than larger firms, which implies a negative relationship between firm size and insurance demand.

Ownership structure

The ownership structure of a company is reflected in its legal form. In this sample the companies are distinguished with regard to risk bearing aspect using their legal form. Therefore, all publicly traded companies, corporations, stock companies etc. are combined under the term "PUBLIC" (in Germany that includes mainly Kapitalgesellschaften such as Aktiengesellschaft/AG, Kommanditgesellschaft auf Aktien/KGaA). All other forms of limited liability by guarantee including limited partnerships etc. are combined as "LIMITED" (this includes German company types such as Gesellschaft mit beschränkter Haftung/GmbH, GmbH & Co. KG). Types of companies with closely held ownership with a single or very few owners bearing all risks such as individual enterprises or sole proprietorships are referred to as "CLOSLEY" (in Germany this includes mainly Personengesellschaften e.g. eingetragener Kaufmann , Gewerbetreibende, self-

employed, Gesellschaft bürgerlichen Rechts and other small partnerships without limited liability). All other types such as cooperatives, associations etc. are combined as "other legal form". For each form a dummy variable, PUBLIC, CLOSELY 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	Frequency	Percent
other legal form	54	2.5
public	57	2.64
closely held	536	70.05
limited	1513	24.81
Total	**2160**	**100**

I expect public companies to demand the least amount of insurance as risk bearing is spread over a larger number of owners. In contrast sole proprietorships are expected to demand more insurance coverage, as the owner bears business risk also with his personal wealth. "LIMITED" is used as reference in the regression model. I therefore expect the signs for CLOSELY to be positive as they are expected to demand more insurance than companies in limited ownership. For public companies the coefficients should be negative as they should demand less insurance than limited companies and therefore the degree of coverage should be smaller. Additionally, I hypothesise that public companies will show a lower degree of coverage than closely held companies as they can spread risk more widely.

Risk bearing

Following the argumentation of e.g. Mayers and Smith (1982) I hypothesise that companies with a higher proportion of risk averse stakeholders to the company's outcome will demand more insurance. As I assume that employees are more risk averse as the owners of a company, I have constructed the variable RISKBEARING which reflects the proportion of employees per Euro turnover by dividing the classes of employees by the classes of turnover. The value of the variable gets larger if more employees account for one Euro of turnover. I therefore expect the sign to be positive following the argumentation that a higher proportion of risk averse stakeholder leads to a higher demand for insurance.

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

Table 5: Summary Statistics

Variable and Description			Obs	Mean	Std. Dev.	Min	Max
degree_coverage	level of coverage = annual maximum indemnity / sum insured		3520	0.9119	0.2487	0	1
revenues	in Euro, measured in 17 classes		2160	6.2759	4.4642	1	17
employees	number of employees, measured in 10 classes		2160	2.7060	2.0558	1	10
size	size = turnover + employees		3520	10.3457	7.5183	2	27
legalform	dummy variable for ownership structure 1 if true, 0 otherwise	public	2160	0.0264	0.1603	0	1
		closelyheld	2160	0.2481	0.4320	0	1
		limited	2160	0.7005	0.4582	0	1
ncontract	number of insurance contracts property and liability		2160	1.5907	2.0681	1	47
riskbearing	proportion of employees to revenues = employees/turnover		2160	0.6240	0.4825	0	10
premiums	paid premiums in Euro p.a.	premium2004	2710	11723.2100	51028.3700	1.36	1148249.00
		premium2005	3031	11819.2100	46362.6200	1.60	944676.90
losspayments	indemnity payments in Euro p.a.	losspayments2004	3520	6260.2870	239141.2000	0.00	14100000.00
		losspayments2005	3520	6182.6390	112937.2000	0.00	4890108.00
nlosses	number of losses p.a.	nlosses2004	3520	0.4193	1.3474	0	31
		nlosses2005	3520	0.4611	1.7223	0	51
lossratio	losses in % of premiums paid	lossratio2004	2710	590.9631	22035.0900	0.00	1145222.00
		lossratio2005	3031	90.4673	775.2332	0.00	25976.15
sum_insured	property insurance sum		3520	84400000	316000000	2556	5800000000

4   Results and Discussion

The data for this analysis were provided by a German insurance company. As uninsured companies are excluded by the nature of the data information about uninsured firms is not obtainable. The sample consist only of insured firms, thus, "degree of coverage" is a limited dependent variable. This variable is truncated at the lower level as its value for all companies in our sample is > 0 and no information about the whole population is available. I conduct a truncated regression model to test the hypotheses concerning the corporate insurance demand (Greene, 2011; Wooldridge, 2006, p. 613-615; Baum, 2006, p. 259-262). The results are shown in table 6.

The results of the truncated regression are displayed in two models. Model A analyses the effect of company size, ownership structure and the risk bearing variable on the chosen degree of insurance coverage as well as control variables for the number of contracts, premiums, losses and loss ratio for both of the available years.[3] Model B is extended by the indicator variables for the industry type. The likelihood-ratio test shows that Model B has a significant higher fit with $LR\ chi2(24) = 197.69, Prob > chi2 = 0.0000$.

The regression shows the coefficient for the variable SIZE with a negative sign, supporting our hypothesised relationship that the demand for insurance decreases with increasing company size. This result is robust when the indictor variables for industry into the regression are introduced. The findings therefore support theories stating that larger firms on average demand less insurance. This is in line with most of other empirical studies and across these studies, results regarding company size seem to more often give support to the hypothesis that size is negatively connected with insurance demand. But as also contradicting results across different studies and research designs appear it is still open which of the size related arguments might drive the insurance demand (diversification, access to finance, sophisticated risk management, less dependence on insurer's real services etc.) and more research might shed light on this.

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[3] The model fit is better when including premiums and losses for both 2004 and 2005, than only 2004. Likelihood-ratio test LR chi2(4) = 15.51, Prob > chi2 = 0.0038

Table 6: Truncated regression model on corporate insurance demand

degree_coverage	A Coef.	A z	B Coef.	B z
size	-0.00540560	-9.34 ***	-0.00376680	-5.82 ***
public	-0.01272640	-0.68	-0.07060500	-3.27 ***
closely	0.00985920	1.01	-0.00698720	-0.73
riskbearing	-0.05505210	-7.37 ***	-0.04575280	-6.20 ***
ncontract	0.00037690	0.56	0.00301790	4.00 ***
premium2004	-0.00000106	-4.61 ***	-0.00000085	-4.02 ***
premium2005	-0.00000054	-2.34 *	-0.00000051	-2.36 *
losspayment2004	0.00000008	5.72 ***	0.00000003	2.12 *
losspayment2005	-0.00000002	-0.17	0.00000006	0.53
nlosses2004	0.00148470	0.41	-0.00169220	-0.48
nlosses2005	0.00837990	2.63 **	0.00699290	2.25 *
lossratio2004	0.00000003	0.18	0.00000006	0.38
lossratio2005	0.00000556	0.73	0.00000156	0.21
Automobile_Retail			0.10982830	3.76 ***
Wholesale			0.01765670	0.54
Construction			0.12759790	2.44 *
Engineering			0.02863940	0.89
Mining			-0.02272100	-0.57
Chemicals			0.00120090	0.03
Metal			0.02962090	0.94
Paper			-0.02956320	-0.75
IT_Software			-0.02866000	-0.70
Services			0.01099370	0.33
Energy_Water			0.14941390	3.45 ***
Waste_Recycling_Sewage			-0.21507120	-1.94 +
Food_Textiles			-0.01499820	-0.42
Hotels_Restaurants			0.11119380	0.83
Petroleum			0.60600160	5.04 ***
Automobile			0.12758150	2.86 **
Transport			-0.09516190	-1.65 +
Agriculture			0.21072410	2.90 **
Health			0.00488890	0.07
RealEstate_Property			0.10640980	2.72 **
Insurance			0.16006840	3.01 **
Furniture_Wood			-0.02754170	-0.73
Banking			0.16168070	1.83 +
Other			0.07497040	2.06
_cons	1.03873900	105.56 ***	0.94471850	31.47 ***
sigma	0.19245800	72.34 ***	0.18513590	72.32 ***
number of obs	2621		2621	
Wald chi2	350.29		616.62	
Prob > chi2	0.0000		0.0000	
Log likelihood	607.33310		706.17612	

reference indicator variables: limited / retail | significance levels: 0.001 *** | 0.01 ** | 0.05 * | 0.1 +

The coefficients for the ownership structure variable PUBLIC indicate that publicly traded companies demand less insurance coverage than limited companies (the reference category in the regression) as the coefficients are negative in both regressions. But when the indicator variables for industry are included the coefficient gets highly significant. This result is in line with our assumed relationship that publicly listed companies such as stock companies demand less insurance than

other firm types. The coefficients for closely held firms are positive but not significant. Therefore, the result for single enterprises is not so clear. It can be stated that, at least in our sample, public liability companies demand less insurance than companies with other legal forms and ownership structures. This supports the argument, that the diversification opportunities of the owners/shareholders affect the risk bearing capacity and decision making of the company. Other empirical studies support this argument as well (e.g Mayers and Smith, 1990 for the insurance industry).

But overall, the result for the influence of ownership structure on the demand for insurance is not as clear as expected and we cannot find a clear pattern for companies with other legal forms. Considering other empirical tests on the ownership structure, results are mixed. There are both, studies indicating to an influence of the ownership structure on corporate insurance demand (Mayers and Smith, 1999; Regan and Hur, 2007; Cole and McCullough, 2007) and studies indicating to no influence or an unclear relationship (e.g Zou, Adams and Buckle, 2003; Yamori, 1999). Yamori (1999) for example did not find a significant effect of ownership structure and traces this back on weak proxies for ownership structures. I could identify the legal form of the companies which we perceive as a good indicator of the ownership structure. However, this does not allow to see for example whether a stock company is dominated by a majority shareholder or ownership is widespread.

The RISKBEARING variable, which measures the proportion of employees to turnover, is highly significant over both regression models showing a negative sign. This means that companies where more employees account for one Euro of turnover demand less insurance coverage. This is contradictory to our hypothesized relationship, where I expected that a larger proportion of risk averse stakeholders, in particular employees, would lead to a higher demand for insurance in order to take care for their individual risk in the company. In our sample this is not the case. This might be due to measuring problems as the variables turnover and employees are only available in categories. Additionally, these variables also account for company size.

To be able to control for different insurance demanding behaviour across different industries, dummy variables for each industry are included. The retail sector serves as reference. The analysis shows that industries such as automobile, insurance, energy/water, real estate/property, construction, banking and auto retail significantly demand a higher insurance coverage for their property insurance. Significantly less insurance coverage is chosen by the transport and the waste/recycling, retail, furniture/wood, food/textiles or service industry. From our aggregate point of view there is no strong common pattern of industries demanding more resp. less insurance coverage. Our findings are partly supported by Thomann and Schulenburg (2006) who find a high demand for terrorism insurance coverage within real estate firms and funds as well as insurance companies.

Automobile retailers show a significantly higher insurance demand. The sample provides 1486 automobile dealers which predestines this subsample for a deeper analysis. Car dealers get offered a customised and standardised insurance policy from this insurance company, and as result all but one car dealers demand full insurance coverage, therefore preventing a meaningful analysis regarding the level of insurance demand.

With a view to regulation of different industries there is no clear pattern. In Germany we consider the health sector as well as financial services (including banks and insurance companies) as highly regulated industries. Other well regulated industries are waste/sewage/recycling, transport or energy/water. The regression analysis shows that firms of the financial services as banks and insurance companies as well as energy/water and health demand more coverage compared to the retail sector, others such as waste/recycling or transport demand less. We therefore can find evidence for both arguments: On the one hand side, as regulated industries tend to have a lower risk of insolvency they need not to buy as much insurance. On the other hand side as they can often pass additional cost for insurance contracts to the customer they do not have incentives to lower the insurance demand. Further research in this direction might be useful, as the regulation of industries is manifold. Perhaps a more precise distinction between the types and depth of regulation might lead to further insights to this question. Additionally, Michel-Kerjan, Raschky and

Kunreuther (2014) have argued that the insurance risk premium might already account for differences in risk exposure amongst industries and this might be true in our study as well.

The control variables regarding contracts, losses and premiums give also valuable insights. The coefficient of the number of contracts (NCONTRACT) a company has with this insurer is positive and highly significant in the full regression model. That means that the level of insurance coverage is higher the more contracts a company has. The interpretation of this phenomenon might be connected with questions of risk averse behaviour of/in companies or of the relationship of a company with its main insurer. But so far there is no clear and intuitive explanation out of the available data.

Another important driver of the insurance demand are the premiums paid. The higher the insurance premiums the lower is the level of insurance coverage. Companies have to balance the level of insurance coverage together with the amount of premiums to pay when deciding on an insurance contract (see also Michel-Kerjan, Raschky and Kunreuther, 2014). The insured companies obviously account for a higher premium by lowering the level of coverage. But the data do not allow us to analyse whether this might be also risk related. Furthermore, analysing the influence of the number and amount of losses as well as the loss ratio, there is no clear picture. I would have expected that companies with a high loss ratio would demand more insurance as they benefit more from paying for insurance coverage (see also Zou, Adams and Buckle, 2003 or Regan and Hur, 2007). But the pure premium payments seem to be a stronger influence factor than the cost-effectiveness of an insurance contract.

I am well aware that the sample of companies is biased. On the one hand side there is the selection bias as the data were provided by an insurance company and therefore this dataset consists only of companies with a positive degree of coverage. I tried to control for this bias by choosing the appropriate regression technique in form of the truncated regression analysis. On the other hand side, the distribution of industries in our sample is also not representative. A large number of firms are automobile retailers, as the insurance company has developed a special policy for this business. 69% (1486) of all firms in our sample belong to this group of automobile

retailers. The two-sample Wilcoxon-Mann-Whitney test shows that the two samples differ (Ho: degree~e(Automo~l==0) = degree~e(Automo~l==1) | z = -21.469 |　　Prob > |z| = 0.0000). To test the robustness of our results I have conducted the analysis without the automobile retailers. The results are displayed in table 7.

Table 7: Truncated regression model on corporate insurance demand **without automobile retail**

degree_coverage	Coef.	z	
size	-0.00451590	-4.08	***
public	-0.07256200	-2.30	*
closely	-0.01128500	-0.43	
riskbearing	-0.06187000	-4.28	***
ncontract	0.00314460	2.88	**
premium2004	-0.00000091	-2.84	**
premium2005	-0.00000055	-1.70	+
losspayment2004	0.00000004	1.72	+
losspayment2005	0.00000003	0.19	
nlosses2004	-0.00792590	-0.99	
nlosses2005	0.01249190	1.92	+
lossratio2004	0.00000007	0.28	
lossratio2005	0.00000359	0.30	
Wholesale	0.02009210	0.42	
Construction	0.12950380	1.73	+
Engineering	0.03516430	0.75	
Mining	-0.01854470	-0.32	
Chemicals	0.01038610	0.16	
Metal	0.03329950	0.73	
Paper	-0.02632950	-0.47	
IT_Software	-0.02751200	-0.47	
Services	0.01520470	0.31	
Energy_Water	0.15959630	2.57	**
Waste_Recycling_Sewage	-0.20930720	-1.30	
Food_Textiles	-0.00254350	-0.05	
Hotels_Restaurants	0.11127580	0.58	
Petroleum	0.61291630	3.49	***
Automobile	0.13784820	2.14	*
Transport	-0.08715940	-1.04	
Agriculture	0.22492540	2.17	*
Health	0.00987230	0.10	
RealEstate_Property	0.10835040	1.93	+
Insurance	0.17029090	2.22	*
Furniture_Wood	-0.01982580	-0.36	
Banking	0.16725890	1.33	
Other	0.07835660	1.49	
_cons	0.96009170	21.76	***
sigma	0.26279970	49.79	***
number of obs	1295		
Wald chi2	181.87		
Prob > chi2	0.0000		
Log likelihood	-94.26619		

reference indicator variables: limited / retail

significance levels: 0.001 *** | 0.01 ** | 0.05 * | 0.1 +

In general, we can state, that the main results are similar to the previous regression analysis, including automobile retailers. Overall, the levels of significance are lower, but the main findings are the same.

What we also are able to see from the automobile retailer subsample is that the supply side of insurance plays an important role in determining the level of insurance coverage demanded by the companies. The insurance company which provided the data offers a standard all risk insurance policy with standard insurance sums and maximum annual indemnity payments. This resulted in a very high pick up rate of this standard coverage, only one of the 1486 automobile retailers changed the standard maximum annual compensation away from full coverage. Hence I suggest that further research of the supply side of corporate insurance demand and also of the framing of standard insurance offers on the demand of insurance by commercial customers might be insightful.

Some limitations besides the sample selection bias remain. Only insured companies were analysed in this study, due to the nature of the data. Therefore, we are unable to observe behaviour of uninsured companies. The risk-based premium for insurance coverage is not available as well. If large companies have more power on the insurance market, they might 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. Additionally, the variable to measure company size, turnover and employees, were only available in categories.

5   Conclusion

The purpose of this paper was to analyse the corporate insurance demand for German companies by using a unique dataset provided by a German insurer containing more than 2100 firms. This study contributes to the academic literature mainly in two aspects. First, several studies previously analysed the insurance purchasing behaviour of firms but were nearly exclusively based on American and Asian data. This paper fills the gap of European and especially German evidence on the corporate insurance demand and therefore, broadening the empirical foundation of these theories. Second, this paper contributes to the literature on corporate insurance demand by adding

evidence for other factors which have an influence on the insurance demand, such as the number of insurance contracts or premiums paid. Third, the analysis sheds light on the importance of contract design and the supply of insurance.

Conducting a truncated regression analysis, our findings support the assumption that the demand for insurance is decreasing with larger company size. There is also evidence that the ownership structure, in our sample proxied by the legal form of the company, influences the amount of insurance coverage purchased. In our dataset in particular public limited liability companies, such as stock corporations, demand significantly less insurance coverage than other company types. However, I could not find strong evidence that companies where the owner bears the firm risk also with his/her personal wealth, such as sole proprietorships, demand more insurance coverage.

Another interesting result of our study is the influence of the premium paid. I find that a higher premium significantly leads to a lower demand for insurance. Even though it can be assumed that the premiums are risk adjusted, the companies adjust for higher premiums with a lower insurance coverage. The data do not show a clear pattern of insurance demand across different industries. Also focussing on regulated industries such as insurance or the energy and water supply sector, a clear direction of the influence of regulation or industry type on the demand for insurance cannot be found. It might be beneficial, if future research refines the form and depth of regulation to analyse its impact on the demand for insurance.

Finally, I can emphasise that the supply side of insurance also plays an important role in determining the demand of insurance. A large proportion of our firm sample was offered a business-type customised standardised insurance contract. As a result, with one exemption, all firms in this business picked up full insurance with standard insurance sums offered. This gives support to the influence of behavioural and cognitive aspects such as framing and anchoring. It might be therefore beneficial to study the effect of the insurance supply, contract design and standardisation also in a corporate insurance environment.

In summary, mirroring our results with those of previous empirical studies, some hypotheses are supported by some studies while others are not supported. Therefore it can be stated, that overall the empirical support of the theories why firms purchase insurance and which factors are determining the demand for insurance is mixed. It therefore might be beneficial to conduct longitudinal studies or cross-sectional studies with larger and international firm samples. Moreover it might be interesting to derive factors influencing the corporate demand for insurance with exploratory studies out of an empirical environment as well as include behavioural aspects of the decision making in companies with regard to insurance. This might be a chance to derive factors or interdependencies with clearer impact for later tests.

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