Cost stickiness and the firm's organizational form: evidence from the property-liability insurance sector

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Abstract We examine the existence of cost stickiness in the German property-liability insurance sector by analyzing if the percentage increase in administrative costs for a rise in premiums is larger than the percentage decrease in administrative costs for an equivalent drop in premiums. In addition, we analyze if sticky cost behavior depends on insurance firms' organizational form. Using company-level data from German property-liability insurance firms for the years 2001–2017 and regression analyses, we find that administrative costs are sticky in the insurance sector, as administrative costs increase on average 0.82% per 1% increase in premiums but decrease only 0.6% per 1% decrease in premium income. Moreover, we find that stock insurers exhibit lower levels of cost stickiness, indicating better monitoring mechanisms.

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Eine Analyse der Kostenremanenz für die deutsche Schaden-/Unfallversicherungsindustrie unter Berücksichtigung der verschiedenen Rechtsformen

Zusammenfassung Wir untersuchen die Existenz der Kostenremanenz in der deutschen Schaden-/Unfallversicherungsindustrie indem wir analysieren, ob der prozentuale Anstieg der Verwaltungskosten im Falle eines Prämienwachstums größer ist als die prozentuale Verringerung der Verwaltungskosten im Falle eines gleichhohen prozentualen Rückgangs der Prämien. Zudem untersuchen wir, ob die Kostenremanenz von der Rechtsform der Versicherungsunternehmen abhängt. Unser Datensatz umfasst deutsche Schaden-/Unfallversicherer auf Einzelunternehmensebene der Jahre 2001 bis 2017. Unsere Analyse weist auf die Existenz der Kostenremanenz hin, da Verwaltungskosten im Falle eines einprozentigen Prämienwachstums im Durchschnitt um 0,82 % ansteigen, sich jedoch im Falle eines einprozentigen Prämienrückgangs nur um 0,6 % verringern. Zudem zeigen unsere Ergebnisse ein geringeres Maß an Kostenremanenz von Aktiengesellschaften im Vergleich zu Versicherungsvereinen auf Gegenseitigkeit. Dies deutet auf bessere Kontrollmechanismen bei Aktiengesellschaften hin.

1 Introduction

The current market environment emphasizes the importance of cost management in the insurance sector. In particular, the low interest environment erodes investment income and the digital transformation requires enormous resources, putting pressure on insurance firms' profitability. Hence, to ensure sufficient funds for current challenges, cost management is an essential determinant of success in the insurance sector. This also holds for cost cutting measures in volatile times, that is, if activity levels decrease, costs should decrease accordingly in order to maintain profitability. However, previous research from other industries shows that the decrease in costs is smaller for decreasing than the increase in costs for increasing activity levels for a given amount of change (Anderson et al. 2003; Guenther et al. 2014). This asymmetric effect is called 'cost stickiness'. The behavior of costs for differing levels of activity has to be closely analyzed, as non-consideration of cost stickiness deteriorates planning and may lead to suboptimal decisions (Anderson et al. 2003).

In this research, we examine the existence of cost stickiness in the German property-liability insurance sector. We analyze if the magnitude of an increase in administrative costs associated with an increase in levels of activity is greater than the magnitude of a decrease in administrative costs associated with an equivalent decrease in levels of activity (Anderson et al. 2003). In particular, we follow related papers (e.g. Anderson et al. 2003, Balakrishnan et al. 2004) and test for sticky cost behavior by estimating an empirical model that relates changes in the insurance firms' administrative costs to contemporaneous changes in their premium income, thereby analyzing if the percentage increase in administrative costs for a rise in premiums is larger than the percentage decrease in administrative costs for an equivalent drop in premiums.

In addition, previous papers indicate that the degree to which cost stickiness occurs depends on the firms' corporate governance structure and agency-related reasons (Chen et al. 2012, Calleja et al. 2006). While some costs are sticky by nature and cannot be affected by managers (such as long-term purchase contracts), there are agency-related reasons why costs are not reduced in times of decreasing activity levels (Guenther et al. 2014; Chen et al. 2012). Based on the agency theory, managers are self-interested and therefore make decisions to maximize their own utility. For example, managers might try to avoid a loss of status when their division is downsized or refrain from dismissing familiar employees (Guenther et al. 2014). Such agency-related cost stickiness might be mitigated by adequate corporate governance mechanisms, if managers are properly monitored. The insurance industry offers a unique setting for an analysis on the role of corporate governance on cost stickiness, as the industry comprises, apart from stock insurance firms, mutual insurance companies.¹ In these organizations, policyholders are the owners of the firms. In contrast to stock insurance firms, where stockholders want to maximize their own profits, mutual insurance firms aim to provide insurance coverage for their members, hence mitigating customer-owner conflicts. This benefit, however is offset by less effective control of the owner–manager conflict (Mayers and Smith 2013). While the stock ownership form provides more effective mechanisms due to their alienable ownership claims (providing, e.g. the possibility of proxy fights or hostile takeovers), the control mechanisms for mutual firms are much weaker (Cummins et al. 1999). This makes it more difficult to mitigate agency-related reasons for cost stickiness. Moreover, as stock insurance firms are strictly profit-oriented, manager's compensation in stock companies is closely linked to corporate performance, hence incentivizing them to reduce costs in order to meet profitability targets (Dierynck et al. 2012). Therefore, we expect that the degree of cost stickiness will be more pronounced in mutual insurance firms relative to stock insurance firms.

Our research builds on various studies that analyze the stickiness of costs and the determinants of this cost behavior for firms from the industrial or non-financial service sector (e.g. Anderson et al. 2003; Balakrishnan et al. 2004). However, sticky cost behavior varies between industries due to differences in production, operational, and economic environments (Subramaniam and Watson 2016). For example, compared to industrial firms, insurance firms' show higher proportions of labor costs, but much lower proportions of costs of material and supplies with respect to their overall costs. As labor costs are relatively inflexible in the short run, insurance firm's cost behavior might strongly differ from industrial firms. Moreover, Germany has very strict labor market rules, making it more difficult to adjust a firm's staff in times of decreasing levels of activity. Hence, the results from previous studies from other industries and countries are not directly applicable for the German insurance industry. Moreover, we build on related studies which examine the differences between stock and mutual insurance companies, e.g. regarding their efficiency (Cummins et al. 1999) and product focus (Lamm-Tennant and Starks 1993), but have not analyzed the impact of insurance firms' organizational form on their cost behavior. We fill

¹ Apart from mutual and stock insurance firms, other organizational forms such as Llyods exist. See Mayers and Smith (2013) for a comprehensive review on organizational forms in the insurance sector.

this gap by providing evidence on the role of insurance firm's organizational form with respect to the degree to which their administrative costs are sticky.

For our analysis, we use company level data from German property-liability insurance firms for the years 2001–2017. Our sample contains 1426 firm year observations for 109 insurance firms. Using regression analyses, our results indicate that administrative costs are sticky in the German insurance industry: We show that administrative costs increase on average 0.82% per 1% increase in premiums but decrease only 0.6% per 1% decrease in premium income. This is consistent with the findings of related studies for other industries (Anderson et al. 2003). Moreover, our results indicate that cost stickiness is more pronounced in mutual insurance firms, consistent with theory that predicts that mutual insurance firms have weaker control mechanisms than stock insurers and therefore lower means to reduce agency problems within their organizations. Our results are robust to the inclusion of different company-level factors which might explain insurance firms' cost behavior.

We contribute to the literature by providing an analysis of cost stickiness in the insurance sector, hence extending the existing literature which is mostly focused on firms from the industrial or non-financial service sector (e.g. Anderson et al. 2003; Chen et al. 2013). Moreover, we provide evidence that a firm's organizational form is an important determinant of the degree of cost stickiness. We show that costs are more sticky in mutual insurance companies, hence extending the existing literature on the effect of corporate governance on cost behavior (e.g. Calleja et al. 2006) and on the differences between stock and mutual insurance companies (e.g. Cummins et al. 1999). Our results are particularly relevant for managers of insurance firms, as the current market environment strongly emphasizes the importance of cost management. As investment income erodes in the current low interest environment and the digital transformation puts pressure on firms to become more cost efficient, knowledge on the cost behavior for different levels of activity is highly valuable. Moreover, imprecise information on cost behavior leads to wrong planning and suboptimal decisions (Anderson et al. 2003), hence knowledge on the degree of cost stickiness can help to improve the performance of insurance firms.

The remainder of this paper is organized as follows: The next section provides the Literature Review and Hypotheses Development. This is followed by the Data and Methodology sections, respectively. The Results appear in the succeeding section, and the Conclusion follows.

2 Literature review and hypotheses development

We start our analysis by providing an examination on the development of insurers' average premium income (measured by GWP) and administrative costs for property-liability insurers during our sample period (2001–2017) in Fig. 1. Table 1 provides detailed information for both measures in each year. Fig. 1 indicates that both average administrative costs and premium income increased during our observation period. In general, both measures show similar developments. For example, in 2010, cost changed by −2.5% while premiums changed by −2.4%. In other years, however, both measures developed differently from each other. For example, in 2016, premiums

Fig. 1 German property-liability insurers' GWP and administrative costs: 2001–2017 (Graph) (This figure plots the average gross written premiums (GWP) and administrative costs for the sample of property-liability insurers in our dataset for the years 2001–2017. The *solid line* presents the average GWP and the *dashed line* shows average administrative costs)

increased by 0.5% while costs decreased by 2.2%. Such heterogeneous development indicates that costs do not necessarily change proportionally, hence indicating the need for a more pronounced analysis of the cost behavior of German property-liability insurers.

Cost management, and in particular the behavior of costs, is an important issue for virtually every firm.² Traditionally, cost functions have been considered as linear functions, including fixed and variable costs (Guenther et al. 2014). While fixed costs are mostly inflexible on the short run, variable costs are considered as flexible and change proportionately with respect to changes in the level of activity (Noreen 1991; Anderson et al. 2003). This implies that the magnitude of cost changes should be independent from the direction of activity changes (decrease or increase). However, previous research (e.g. Anderson et al. 2003; Balakrishnan et al. 2004; Subramaniam and Watson 2016) shows that the decrease in costs is smaller for decreasing than the increase in costs for increasing activity levels for a given amount of change (Guenther et al. 2014). This asymmetric effect is called 'cost stickiness'.

Previous literature discussed a variety of reasons for the existence of cost stickiness (Guenther et al. 2014; Anderson et al. 2003):

Legal reasons comprise requirements of employment and social legislation for dismissal and downsizing staff, which make it difficult to quickly adjust staff costs when demand is decreasing. In particular, senior employees cannot be easily dismissed. Additionally, legal reasons include the terms of long-term contracts with external parties, which cannot be cancelled quickly without bearing significant adjustment costs.

Reasons caused by social and personnel policy include decisions of companies that are taken in order to comply with the social conditions and expectations of their environment. For example, firms might not cut their expenses for social objectives in case of decreasing demand, because this would deteriorate their stakeholder's

² See, e.g., Guenther et al. (2014) and Anderson et al. (2003) for a comprehensive literature review on cost behavior and cost stickiness.

Table 1 German property-liability insurers' GWP and administrative costs: 2001–2017

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
GWP (Mio. €)	490.3	455.9	460.4	451.7	465.9	484.9	476.8	465.6	475.3	463.9	482.5	513.5	531.5	539.8	563.6	566.3	617.4
GWP growth (%)	4.7	-7.0	1.0	-1.9	3.1	4.1	-1.7	-2.3	2.1	-2.4	4.0	6.4	3.5	1.6	4.4	0.5	9.0
Costs (Mio. €)	75.8	72.1	71.0	67.4	70.2	78.0	73.4	74.2	77.3	75.4	76.8	83.8	85.2	84.4	88.2	86.3	92.5
Cost growth (%)	4.0	-4.8	-1.6	-5.0	4.1	11.1	-5.9	1.1	4.2	-2.5	1.8	9.1	1.7	-0.9	4.5	-2.2	7.2
<i>N</i>	59	77	78	81	79	81	84	88	88	89	87	87	88	90	89	93	88

The table shows the average gross written premiums (GWP) and administrative costs for the sample of property-liability insurers in our dataset for the years 2001–2017. GWP growth (%) and Cost growth (%) denote the yearly change in these measures compared to the previous years.

N denotes the amount of observations in each year.

opinion of the firm. Similarly, a firm might refrain from dismissing certain employees (for example invalid or older employees) in such a situation due to social considerations.

Reasons caused by firm and operating policy comprise, for example, decisions to keep qualified employees who work together well as a team in times of decreasing levels of activity. This might also be explained by the fact that if activity levels are increasing again, the search for equivalently qualified employee can be difficult and cause even higher costs for the firm.

Psychological and agency-related reasons are mostly related to the manager's behavior: Based on the agency theory, managers are self-interested and therefore make decisions to maximize their own utility instead of focusing on the firm's goals. For example, managers might try to avoid a loss of status when their division is downsized or refrain from dismissing familiar employees. Therefore, if managers are not properly monitored or incentivized, they might be reluctant to decrease their resources in times of decreasing demand, while in times of rising activity levels, they will aim to overproportionally increase their activities, hence contributing to asymmetrical cost behavior.

Previous research provides evidence for the existence of cost stickiness in various industries. For example, Anderson et al. (2003) show that the percentage increase in costs for an increase in sales revenue is larger than the percentage decrease in costs for an equivalent decrease in sales revenue for a large set of industrial firms. Balakrishnan et al. (2004) confirm these findings for physical therapy clinics in the US. However, sticky cost behavior might be strongly pronounced in some industries, but less pronounced in others due to differences in production, operational, and economic environments (Subramaniam and Watson 2016). Hence, the results from other industries might not hold for firms from other sectors, such as the insurance sector.

Insurance business strongly differs from the business of industrial firms.³ Instead of tangible goods, insurance firms produce risk protection for individuals and companies and compensating them in the case of insured losses. Hence, insurers do not require machines and inventories, but strongly rely on the capabilities of their employees, while the asset side of the balance sheet mostly consists of financial assets. This affects the cost behavior of insurers, leading to significant differences when compared to industrial firms.

Insurers mostly generate their revenue from premium and interest payments, while expenses mostly consist of claim payments, distribution and administrative expenses. Though insurance firm's expense structure is usually dominated by claim payments, administrative expenses are still a relevant success factor in the insurance industry. This holds particularly in the current market environment that is dominated by the ongoing process of digitalization and the persistent low interest rates. Both trends increase the pressure on insurance firms to reduce their administrative costs

³ See Rejda and McNamara (2011) for additional information on the principles of insurance business.

in order to have the financial capacity to finance the digital transformation and to counteract lower investment income.

Against this background, we add to the literature an analysis on cost stickiness in the insurance sector and formulate the following hypothesis:

Hypothesis 1: The percentage increase in insurance firms' administrative costs for a rise in premiums is larger than the percentage decrease in administrative costs for an equivalent decrease in premiums.

Moreover, recent research emphasized the role of corporate governance and agency-related reasons for the existence of sticky cost behavior. While some costs are sticky by nature and cannot be affected by managers (such as long-term purchase contracts), most variable costs can be reduced in times of decreasing activity levels, depending on the managers' preferences. However, agency theory posits that managers are self interested and aim to maximize their own utility. Hence, they might refrain from downsizing their departments or dismissing familiar employees (Guenther et al. 2014). Chen et al. (2013) show that cost stickiness increases in the degree of managerial overconfidence. Such managerial-related cost-stickiness might be mitigated by adequate corporate governance mechanisms, if managers are properly monitored. Calleja et al. (2006) state that differences in firms' cost stickiness are attributable to differences in systems of corporate governance and managerial oversight.

While information on the characteristics of internal governance systems are usually not publicly available, the insurance sector offers a unique setting for an analysis, as it mainly comprises two organizational forms with different governance mechanisms, which strongly affects the degree to which principal-agent problems arise and how they are mitigated: Stock insurance firms and mutual insurance firms.⁴ In stock insurance firms, a complete separation of the manager, owner, and customer functions exists. In mutual insurance firms, the policyholders are both customers and owners of the firm. This mitigates customer-owner conflicts, as mutual insurers rather focus on providing coverage for the policyholders than to maximize profits.

This benefit, however, is offset by less effective control of the owner–manager conflict. Agency theory states that, due to the separation of the manager and owner functions, managers do not bear the full wealth effects of their actions. This leads to an incentive problem, as their interests are usually not aligned with the interests of their owners (Mayers and Smith 2013), and thus to the occurrence of agency-related costs. As the manager and owner functions are strictly separated in stock companies, their managers are closely monitored, for example by institutional investors and other large stockholders. Because they have alienable ownership claims, opportunistic behavior by managers can be reduced by, e.g., the possibility of proxy fights or hostile takeovers (Cummins et al. 1999). The control mechanisms available to mutual owners are much weaker, as ownership claims are not alienable, and therefore managers in mutual insurance are usually not monitored by third parties. Moreover, as stock insurance firms are more profit-oriented, manager's compensation in stock

⁴ See Mayers and Smith (2013) for a detailed discussion on the different characteristics of stock and mutual insurance firms.

companies is closely linked to corporate performance, hence incentivizing them to reduce costs in order to meet profitability targets (Dierynck et al. 2012).

Hence, the costs of managerial opportunism are higher in mutual insurance companies when compared to stock insurers. The “expense preference hypothesis” states that managers generate costs that are unnecessary due to the consumption of perquisites. Accordingly, mutual insurers are less successful in minimizing costs than stock insurers because of the different monitoring and incentive structures of their organizational form (Cummins et al. 1999). This in turn leads to a higher degree of cost stickiness of mutual insurers relative to stock insurers. We therefore formulate the following hypothesis:

Hypothesis 2: The degree of cost stickiness is more pronounced in mutual insurance firms relative to stock insurance firms.

3 Data and methodology

3.1 Data

Our analysis includes company level data from German property-liability insurers included in the KIVI database⁵ from 2001–2017. We exclude pure reinsurance firms and global commercial insurance firms, due to their different business models. Insurers with negative or missing total assets, equity, and premiums are dropped. As we focus on comparing stock insurers and mutual insurers, we drop insurance firms with differing organizational forms (state owned insurers⁶ and foreign insurance firms). Moreover, following Chen et al. (2013) and Anderson and Lanen (2009), we drop firms for which costs and revenue move in opposite directions. To reduce the impact of extreme outliers, variables are winsorized at the 1 and 99 percentiles. Finally, we drop firms with missing variables that are required for our analyses in the following sections. Our final sample contains 1426 firm year observations for 109 insurance firms. All variables and their definitions are provided in Table 2.

3.2 Methodology

We follow related studies (Anderson et al. 2003) and use an empirical model that relates changes in administrative costs of insurance firms to contemporaneous changes in gross written premiums while discriminating between periods when premiums increases and premium decreases. The model includes a dummy variable

⁵ The KIVI database includes firm level data for German insurance companies. The database comprises information on the insurers' financial statements, financial ratios and certain non financial characteristics. The database includes firms with GWP above 50 mio. €, but also includes special cases with less than 50 Mio. € GWP. The database covers about 96% of the German market (measured by gross premiums). See Altuntas et al. (2019) for additional information on the KIVI database.

⁶ State owned insurers (Öffentliche Versicherer) are non-profit organizations under public law to serve a certain region or administrative district in Germany. See Rauch and Wende (2015) for additional information.

Table 2 Variables

Variable	Description
Cost (Mio. €)	The insurer's administrative costs (gross)
GWP (Mio. €)	The insurer's gross written premiums (direct)
Cost growth (%)	The yearly growth rate of Cost
GWP growth (%)	The yearly growth rate of GWP
Mutual Dummy	A dummy variable equal to one if insurer i is as mutual insurance company
Assets	The natural logarithm of the insurer's total book assets
Loss Ratio (%)	The insurer's loss ratio (gross)
Equity Ratio (%)	The insurers' total book equity divided by its total book assets
Yield (%)	The insurer's investment result divided by average book investments
Risky Assets (%)	The insurer's equity investments divided by book investments

The table provides the variables and their definitions used in our analyses

(*Decrease_Dummy*) that equals 1 when premiums decrease between periods $t-1$ and t , and 0 otherwise:

$$\log \left[\frac{\text{Cost}_{i,t}}{\text{Cost}_{i,t-1}} \right] = \beta_0 + \beta_1 \log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right] + \beta_2 \cdot \text{Decrease_Dummy}_{i,t} \cdot \log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right] + \varepsilon_{i,t} \quad (1)$$

where $\text{Cost}_{i,t}$ denotes gross administrative cost of insurance firm i in year t and $\text{GWP}_{i,t}$ denotes gross written premiums of insurance firm i in year t . Using a log specification facilitates the interpretation of coefficient estimates and alleviates potential heteroskedasticity. We denote the term $\log \left[\frac{\text{Cost}_{i,t}}{\text{Cost}_{i,t-1}} \right]$ as *Cost Growth (log)*, $\log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right]$ as *GWP Growth (log)* and $\text{Decrease_Dummy}_{i,t} \cdot \log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right]$ as *Decrease Interaction*.

The use of *Decrease_Dummy* allows to distinguish between periods of increasing and decreasing premiums, as the variable is 0 when premiums increase. Hence, β_1 measures the percentage increase in costs for a 1% increase in premiums. In periods of decreasing premium revenue, *Decrease_Dummy* equals 1, the sum of β_1 and β_2 measures the percentage increase in costs for a 1% decrease in premiums. In case of cost stickiness, premium increases should lead to higher changes in costs than decreases. Hence, for our first hypothesis, we expect that $\beta_1 > 0$ and $\beta_2 < 0$ for property-liability insurance firms. If $\beta_2 = 0$, the traditional cost model holds, as premium increases and decreases lead to the same changes in costs. Moreover, if fixed costs are present, $\beta_1 < 1$, indicating the existence economies of scale (Anderson et al. 2003). All models include firm fixed effects. For robustness, all models are also examined including time fixed effects.

For robustness, we control for firm-specific factors which might explain changes in insurance firms' cost behavior in addition to changes in *GWP*. We therefore extend model (1) as follows in additional regression analyses:

$$\begin{aligned} \log \left[\frac{\text{Cost}_{i,t}}{\text{Cost}_{i,t-1}} \right] = & \beta_0 + \beta_1 \log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right] \\ & + \beta_2 \cdot \text{Decrease_Dummy}_{i,t} \cdot \log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right] \\ & + \beta' \text{Control} + \varepsilon_{i,t} \end{aligned} \quad (2)$$

Where *Control* denotes a vector of firm specific variables. The vector includes *Assets*, a measure of companies' size, defined as the natural logarithm of the firms' total book assets. As larger insurance firms are more likely to benefit from economies of scale as they have larger, more diversified risk pools (Altuntas and Rauch 2017; Berry-Stölzle et al. 2010), we assume that this strongly affects their cost behavior. In addition, we include the insurers' *Loss Ratio* as a measure of the insurers' technical profitability. We assume that insurers with a higher *Loss Ratio* are less likely to increase their costs significantly, even if their revenue strongly increases, in order to improve their profitability. As an indicator of the insurers' level of safety, we include *Equity Ratio*, defined as the insurers' total book equity divided by its total book assets.⁷ We assume that higher levels of equity capital relative to the firm's assets indicate a higher level of financial soundness (Sharpe and Stadnik 2007; Cummins and Nini 2002). Insurers which are safer from a financial perspective are more likely to increase costs in times of increasing revenue, but keep costs high in times of decreasing levels of activity, as high equity levels serve as a buffer against losses in case of unfavorable developments. Moreover, apart from operating profitability, we control for the insurers' investment income, measured by *Yield* (the insurer's investment result divided by average book investments). Insurers with higher *Yield* are more flexible with regards to changes in their levels of costs, as higher levels of investment income provide necessary funds to adjust costs in times of changing levels of activity. Finally, we include *Risky Assets*, a measure of the insurer's exposure to volatile assets (equity investments divided by book investments). Insurers with higher levels of *Risky Assets* are less flexible with respect to their cost behavior, as they require buffers in case their risky assets show negative developments.

⁷ The solvency ratio would be a better indicator for the insurer's financial soundness. However, the Solvency II regime has been introduced in the year 2016, following the prior solvency regime (Solvency I). Hence, there are no consistent regulatory measures for the insurers' solvency ratio for our observation period from 2001–2017. We therefore use a book equity based measure for the insurer's financial soundness.

To examine the effect of insurance firms' organizational form on their cost behavior, we extend model (1) and (2) as follows:

$$\begin{aligned} \log \left[\frac{\text{Cost}_{i,t}}{\text{Cost}_{i,t-1}} \right] = & \beta_0 + \beta_1 \log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right] \\ & + \beta_2 \cdot \text{Decrease_Dummy}_{i,t} \cdot \log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right] \\ & + \beta_3 \cdot \text{Decrease_Dummy}_{i,t} \cdot \log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right] \\ & \cdot \text{Mutual_Dummy}_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (3)$$

$$\begin{aligned} \log \left[\frac{\text{Cost}_{i,t}}{\text{Cost}_{i,t-1}} \right] = & \beta_0 + \beta_1 \log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right] \\ & + \beta_2 \cdot \text{Decrease_Dummy}_{i,t} \cdot \log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right] \\ & + \beta_3 \cdot \text{Decrease_Dummy}_{i,t} \cdot \log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right] \\ & \cdot \text{Mutual_Dummy}_{i,t} + \beta' \text{Control} + \varepsilon_{i,t} \end{aligned} \quad (4)$$

where *Mutual_Dummy_{i,t}* is a dummy variable equal to one if insurer *i* is a mutual insurance company. We denote the term $\text{Decrease_Dummy}_{i,t} \cdot \log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right] \cdot \text{Mutual_Dummy}_{i,t}$ as *Mutual Interaction*. In model (4), *Control* is included, analogous to (2). According to hypothesis 2, we expect that the degree of cost stickiness will be more pronounced in mutual insurance firms relative to stock insurance firms, therefore we expect $\beta_3 < 0$.

4 Results

4.1 Descriptive results

Table 3 provides summary statistics for all variables used in our analyses. The table shows that around 50% of property-liability insurers in our sample are mutual insurance companies (indicated by *Mutual Dummy*). Both administrative costs and GWP grew, on average, by 4.4% and 4.9% on average per year during our sample period (indicated by *Cost growth* and *GWP growth*). Hence, the average growth of premiums exceeded the average growth of administrative costs. Moreover, property-liability insurers are, on average, technically profitable and well capitalized, as indicated by *Loss Ratio* and *Equity Ratio*.

Table 3 Summary statistics

Variable	Obs	Mean	Std. Dev	Min	Max
Cost (Mio. €)	1426	78.7	183.9	0.2	1697.5
GWP (Mio. €)	1426	502.0	1091.2	5.0	9439.0
Cost growth (%)	1426	4.4	17.7	-79.0	230.0
GWP growth (%)	1426	4.9	13.0	-89.6	158.9
Mutual Dummy	1426	0.5	0.5	0	1
Assets	1426	5.8	1.5	2.5	9.3
Loss Ratio (%)	1426	67.2	15.3	17.8	104.0
Equity Ratio (%)	1426	22.9	12.0	5.8	66.3
Yield (%)	1426	4.1	2.4	-1.1	14.4
Risky Assets (%)	1426	21.1	16.7	0	75.1

The table shows summary statistics for the country level variables used in the regression analyses

The variables are defined in Table 2

All variable values are reported over the 2001–2017 time period

Obs denotes the amount of observations

Mean denotes the respective mean of the variable

Std. Dev. denotes the standard deviation

Min and Max denote the minimum and maximum observation for each variable

4.2 Empirical results

Table 4 presents the empirical results for Eqs. 1 and 2 for all property-liability insurers in our dataset for the years 2001–2017 in column (A) and (C). The results for both models are also provided including time fixed effects in column (B) and (D). Our results provide empirical evidence for hypothesis 1, as the coefficients of β_1 and β_2 are significant and both coefficients show the predicted directions: The coefficient of $\beta_1 > 0$ for property-liability insurance firms and $\beta_2 < 0$. As indicated in column (A), we show that administrative costs increase on average 0.82% per 1% increase in premiums but decrease only 0.6% per 1% decrease in premium income. This is consistent with the findings of related studies for other industries (e.g. Anderson et al. 2003; Balakrishnan et al. 2004; Subramaniam and Watson 2016). Moreover, as $\beta_1 < 1$, the results provide evidence for the existence economies of scale (Anderson et al. 2003). The results are robust to the inclusion of both time fixed effects and additional control variables, as the coefficients of β_1 and β_2 and their significance in columns (B)–(D) remain very similar to those in column (A).

Hence, our results provide empirical evidence for the existence of cost stickiness in the German property-liability insurance sector: the decrease in administrative costs is smaller for decreasing than the increase in costs for increasing activity levels for a given amount of change. This finding provides highly relevant information for managers and shareholders of insurance firms in the current market environment, as a flexible cost management that quickly adapts the firm's cost behavior in volatile times is an essential success factor. Keeping administrative costs on high levels in cases of unfavorable developments can severely erode the firm's funds that are necessary to remain competitive in a difficult, changing market environment. To control sticky costs, it is important to be aware of this asymmetric cost behavior in advance, and keep a critical view of the flexibility and the degradability

Table 4 Regression results: Cost stickiness in the German property-liability insurance sector

Dependent Variable: Cost Growth (log)	(A)	(B)	(C)	(D)
<i>GWP Growth (log)</i>	0.824*** (0.045)	0.821*** (0.046)	0.842*** (0.045)	0.841*** (0.046)
<i>Decrease Interaction</i>	-0.224*** (0.075)	-0.220*** (0.075)	-0.244*** (0.075)	-0.239*** (0.076)
Assets	—	—	0.017 (0.014)	0.059*** (0.020)
Loss Ratio	—	—	-0.001 (0.000)	-0.001** (0.001)
Equity Ratio	—	—	-0.001 (0.001)	-0.001 (0.001)
Yield	—	—	0.001 (0.002)	-0.000 (0.002)
Risky Assets	—	—	0.001** (0.000)	0.001** (0.000)
Constant	-0.006 (0.004)	-0.005 (0.017)	-0.047 (0.092)	-0.254** (0.118)
R ²	0.287	0.296	0.293	0.307
Adjusted R ²	0.227	0.228	0.231	0.237
Firm fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	No	Yes	No	Yes
Observations	1426	1426	1426	1426

The table shows the results of regression analyses from Eqs. 1 and 2 for all property-liability insurers in our sample for the years 2001–2017

We denote the term $\log \left[\frac{\text{Cost}_{i,t}}{\text{Cost}_{i,t-1}} \right]$ as Cost Growth (log), $\log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right]$ as GWP Growth (log) and

$\text{Decrease_Dummy}_{i,t} \cdot \log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right]$ as Decrease Interaction

All regression analyses include firm fixed effects

Variables are described in Table 2

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively

(Guenther et al. 2014). Moreover, the existence of economies of scale, as indicated by $\beta_1 < 1$, further supports the importance of growth strategies in the insurance sector.

To analyze differences in the cost behavior of stock and mutual insurance firms, Table 5 provides the results for Eqs. 3 and 4 in column (A) and (C). As in Table 4, results for both models are also provided including time fixed effects in column (B) and (D). The results show that the degree of cost stickiness is more pronounced in mutual insurance firms relative to stock insurance firms, as indicated by the significant and negative coefficient of β_3 in column (A). Again, the results are robust to the inclusion of both time fixed effects and additional control variables, as indicated by the empirical results in column (B)–(D) in Table 5. This provides evidence for hypothesis 2.

Our results show that a firm's organizational form strongly determines its cost behavior. We show that, due to better monitoring mechanisms and different compensation structures, stock insurers manage their costs more efficiently, and are able to quickly adapt them to changing (in particular, decreasing) levels of activity. This

Table 5 Regression results: The role of the insurer's organizational form for the degree of cost stickiness in the German property-liability insurance sector

Dependent Variable: Cost Growth (log)	(A)	(B)	(C)	(D)
<i>GWP Growth (log)</i>	0.829*** (0.045)	0.825*** (0.046)	0.848*** (0.045)	0.846*** (0.046)
<i>Decrease Interaction</i>	-0.203*** (0.075)	-0.196*** (0.076)	-0.221*** (0.076)	-0.212*** (0.076)
<i>Mutual Interaction</i>	-0.697** (0.274)	-0.724*** (0.276)	-0.726*** (0.275)	-0.772*** (0.276)
Assets	—	—	0.016 (0.014)	0.058*** (0.020)
Loss Ratio	—	—	-0.001* (0.000)	-0.001** (0.001)
Equity Ratio	—	—	-0.001 (0.001)	-0.001 (0.001)
Yield	—	—	0.001 (0.002)	-0.001 (0.002)
Risky Assets	—	—	0.001** (0.000)	0.001** (0.000)
Constant	-0.006 (0.004)	-0.009 (0.017)	-0.035 (0.092)	-0.245** (0.118)
R ²	0.290	0.300	0.297	0.312
Adjusted R ²	0.230	0.232	0.234	0.241
Firm fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	No	Yes	No	Yes
Observations	1426	1426	1426	1426

The table shows the results of regression analyses from Eqs. 3 and 4 for all property-liability insurers in our sample for the years 2001–2017

We denote the term $\log \left[\frac{\text{Cost}_{i,t}}{\text{Cost}_{i,t-1}} \right]$ as Cost Growth (log), $\log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right]$ as GWP Growth (log) and $\text{Decrease_Dummy}_{i,t} * \log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right]$ as Decrease Interaction

The term $\text{Decrease_Dummy}_{i,t} * \log \left[\frac{\text{GWP}_{i,t}}{\text{GWP}_{i,t-1}} \right] * \text{Mutual_Dummy}_{i,t}$ denotes Mutual Interaction
All regression analyses include firm fixed effects

Variables are described in Table 2

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively

provides an important success factor in challenging market environments. Hence, our research adds an important contribution to the strand of literature which examines differences in insurance firms' organizational forms (e.g. Cummins et al. 1999).

5 Conclusion

We analyze the existence of cost stickiness in the German property-liability insurance sector, by analyzing if the magnitude of the increase in administrative costs associated with an increase in levels of activity is greater than the magnitude of the decrease in administrative costs associated with an equivalent decrease in levels

of activity. Moreover, we examine if the insurers' organizational form affects the degree to which cost stickiness occurs by analyzing differences in the cost behavior of stock and mutual insurance companies.

Using a dataset of 1426 firm year observations of German property-liability insurance firms for the years 2001–2017, we find that administrative costs increase on average 0.82% per 1% increase in premiums but decrease only 0.6% per 1% decrease in premium income. This provides empirical evidence for the existence of cost stickiness in the German insurance sector. Moreover, our results indicate that cost stickiness is more pronounced in mutual insurance firms, consistent with theory that predicts that mutual insurance firms have weaker control mechanisms than stock insurers and therefore lower means to reduce agency problems within their organizations.

We contribute to the existing literature by providing an analysis of cost stickiness for the insurance industry. Because the current market environment emphasizes the importance of cost management in the insurance sector, our research provides important finding for managers, investors and regulators of insurance firms. Furthermore, the suitability of standard cost accounting tools has to be questioned, and possibilities to adjust them given the existence of sticky cost behavior have to be discussed (Banker et al. 2011). In addition, we show that the degree of cost stickiness differs between stock and mutual insurance firms, as the cost behavior of the latter show higher levels of cost stickiness. This provides an important contribution to the literature that examines differences between mutual and stock insurance companies.

While our study is the first to analyze the existence and determinants of cost stickiness in the insurance sector and on the impact of the firm's organizational form on the degree of cost stickiness, it leaves room for additional research. In particular, the use of more sophisticated econometric design might further corroborate the results of our analyses. For example, as cost stickiness might not be linear, depending on various conditions, more advanced research approaches such as the use of structural equation models might explain more complex structures for cost stickiness (Guenther et al. 2014). Moreover, our study focuses on the behavior of total administrative costs. Future research might provide information about the components of sticky costs and analyze a finer disaggregation of the administrative costs (Anderson et al. 2003; Guenther et al. 2014). In addition, while our research indicates the existence of cost stickiness in the German property-liability insurance sector, it is an open question if these results are also applicable in the life/health insurance sector or in the insurance markets in other countries. Finally, as cost management is particularly relevant in times of economic downturn, a closer examination of the period of the financial crisis of 2007–2009 or the most recent corona crisis in 2020 might complement our analyses.

Our study does suffer from data limitations. While we expect that the degree of cost stickiness will be heterogeneous across the insurance industry, as insurance firms with quickly scalable business models (such as direct/online insurers that focus on a single line of business) might show lower levels of cost stickiness when compared to insurance firms with more complex business models (such as industrial insurers that strongly depend on brokers, therefore needing to adapt their distribution support in case of changes in their level of activity), detailed information on the insurer's

business model is unfortunately not available in our dataset. Hence the impact of different business models on the degree of cost stickiness can only be analyzed rudimentarily. Moreover, our analyses include several firm level factors that explain the degree of cost stickiness. However, other factors that could affect insurance firms' cost behavior, such as the quality of the firms' internal accounting systems and governance, would provide useful information, but are not available for all firms in our dataset. As insurers' costs are strongly determined by staff costs (in particular, salaries), a respective measure would be particularly relevant.⁸ Moreover, our study is not able to evaluate the role of managerial decision making and their motives due to the absence of the respective information. Developing a greater understanding of the managerial decision-making processes would greatly improve the understanding of cost stickiness (Anderson et al. 2003).

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⁸ As we include information on subsidiary-level and not on a holding level, we do not have a reliable indicator for the amount of employees and staff costs available. Many subsidiaries do not employ their own staff, but rely on their parent companies instead. Hence, available measures of employees and staff costs do not provide reliable indicators for our analyses.

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