The Effect of Regulation on Comparative Advantages of Different Organizational Forms: Evidence from the German Property-Liability Insurance Industry

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1. Introduction

The relation between organizational structure and efficiency has been an important topic in the insurance literature (e.g. Weiss, 1991; Cummins, Weiss, Zi, 1999). Agency theory has led to the development of several hypotheses about organizational forms, resulting from the observation that stock companies and mutual companies have comparative advantages in dealing with different types of agency costs (Jensen and Meckling (1976), Mayers and Smith (1981) and Fama and Jensen (1983)).

Demsetz and Lehn (1985) suggest that regulation "provides some subsidized monitoring and disciplining of the management of regulated firms."[1] We modify Demesetz and Lehn (1985) and argue that the regulatory environment restricts the way insurance companies can conduct business, hence, influences the goals of the owners, managers and policyholders of these companies. We extend the literature and suggest that the comparative advantages of different organizational forms depend on the regulatory environment.

The goals of this paper are two folds. First, we examine the relation between efficiency and organizational structure in the German insurance industry. Second, we investigate the effect of the regulatory framework on the relative efficiency of alternative organizational forms in the insurance industry. We test our hypothesis using the data from the German property-liability insurance industry.

The reasons we choose the German property-liability insurance industry as our sample are stated below. First, the German property-liability insurance industry is different from the U.S. in that there exists one special type of organizational form, public insurance companies, in the German property-liability insurance industry. More important, pubic insurers were founded as non-profit organizations with the purpose to serve a certain region or administrative district and were equipped with monopoly authorization for a compulsory business line for their district before 1994. We hypothesize that public insurers are more cost efficient then stock insurers if they have monopoly authorization for a compulsory business line. We refer to this hypothesis as the *compulsory monopoly hypothesis*.

Second, the German insurance market went through a major change in the regulatory environment. Specifically, the deregulation of the German insurance market on July 29, 1994 changed the regulatory regime dramatically, while the market and other institutional details have

[1] Demstz and Lehn (1985) forcus their discussions on the relation between the regulation and ownship concentration.

remained relatively stable. This natural experiment allows us to analyze the efficiency of insurance companies with different organizational forms in the pre- and post-deregulation period separately.

Third, it should be noted that the regulatory regime restricts competition (such as uniform product) and especially provides disincentives to minimize costs before 1994. We extend the literature and suggest that the comparative advantages of different organizational forms depend on the regulatory environment. We refer this hypothesis as the *regulatory hypothesis*.

Our analysis provides four main results: First, our results are consistent with our hypotheses that regulation influences comparative advantages of organizational forms. Specifically, we find that the stock cost frontier does not dominate the cost frontiers of the other organizational forms during the regulated period when regulation was very strict. This result is consistent with the *regulatory hypothesis*. More important, we find that the public cost frontier dominates the stock cost frontier for this time period. This result is striking because it is not consistent with the *expense preference hypothesis*. The finding is consistent with the *compulsory monopoly hypothesis*. We attribute these findings to the monopoly of public insurers in the compulsory building insurance line which existed until July, 1994 because of regulation.

Second, consistent with the *expense preference hypothesis*, the stock cost frontier dominates the public cost frontier after the deregulation. In other words, the *expense preference hypothesis* is supported by our evidence after the deregulation for the relation between stock and public insurers. The first two results imply that the regulation plays an important role for efficiency.

Other findings are stated below. First, stock, mutual and public insurers are operating on separate production hence represent different technologies. Second, the stock technology dominates the mutual technology for producing stock outputs and the mutual technology dominates the stock technology for producing mutual outputs. The same relationship holds for the stock technology and the public technology. These findings support the *efficient structure hypothesis*.

In addition, we contribute to the literature on alternative organizational forms by including publicly owned insurance companies in our analysis.

This paper proceeds as follows. In the next section we describe the German Insurance market and its regulation. Section 3 develops hypotheses. We discuss data and methodology in section 4. Section 5 shows the results. The final section concludes.

2. The German Insurance Market and its Regulation

The German insurance market is the fifth largest, in terms of premium revenue, of all insurance markets in the world and the third largest in Europe. The German property-liability insurance market is the largest in Europe and the second largest worldwide. The insurance sector in Germany represents 6.8 percent of the country's total GDP in 2006 (Europe: 9.0 percent). As in the United States, most insurers are organized as stock companies (75 percent) or mutual associations (20 percent). However, there is a third organizational form in Germany, namely public insurance companies (5 percent). These insurers are created by a public decree, are subject to public law and serve a public purpose.

Public Insurance Companies in Germany

A specific characteristic of the German insurance market is the existence of public insurance companies as a third organizational form besides stock insurers and mutual insurers. The development of the German insurance industry dates back to the 16th century when the first private forms of fire insurance carriers were established. Since the availability of fire insurance was seen as an important public good, various German states set up numerous public fire insurance companies during the 18th century. These insurers were founded as non-profit organizations with the purpose to serve a certain region or administrative district and were equipped with monopoly authorization to offer fire insurance coverage for buildings in their district. Furthermore, in regions served by a public insurance company, it was usually compulsory for owners of buildings to purchase fire insurance coverage from these companies. The monopoly authorization of public insurance companies as well as the legal obligation to insure buildings was later extended to include additional perils like earthquake, flood, avalanche and volcanic eruption. Even though the monopoly authorization of public insurance companies, the legal obligations to insure buildings with these companies, as well as the tie of public insurers to a certain administrative district were abolished together with the deregulation of the German insurance market in 1994. Most public insurers still restrict their business to "their" region till this date. Because public insurers have the goal to serve their policyholders, they were not subject to regulatory supervision until after World War II.

At the beginning of the 20th century, public insurers started to extend their business to other lines of property-liability insurance as well as life insurance and competed with private insurers. Foundations of public life insurance companies were usually the result of alliances between states and municipal saving banks. Until today, public insurers take their mandate to serve the public very seriously and play an important role in providing local employment opportunities and in the promotion of arts, sciences, sports and social activities.

An important characteristic of public insurance companies is that they are now all owned by municipals savings banks (*Sparkassen*) and their associations (*Sparkassenverbänden*). After the monopoly authorization of public insurers fell together with the deregulation of the German insurance market, the German states sold their shares in the public insurance companies to the municipal savings banks. The motivation for these transactions was that an alliance with the group of the municipal savings banks will help public insurers to compete in a deregulated insurance market.

Municipal savings banks in Germany are non-profit savings and loan banks set up under public law with the purpose to serve a certain region or administrative district. All municipal savings banks are organized in associations which are themselves members of one umbrella association (*Deutscher Sparkassen und Giroverband*). These associations provide services to all member savings banks like joint marketing activities and consulting services. Municipal savings banks in Germany have their own deposit guarantee scheme which is based on a joint liability with respect to deposits. Therefore, the group of municipal savings banks can be viewed as a decentralized financial conglomerate under public law, and this conglomerate now also includes investment companies, home savings and loan associations, leasing companies, factoring companies as well as all twelve public insurance companies. Municipal savings banks are one of the major providers of corporate loans and mortgages. These loans and mortgages usually have an insurance requirement on the property used as security resulting in substantial cross-selling opportunities for insurance products.

During the regulated era, public insurers had monopoly authorization for policies covering direct damage to building structures through fire and other perils. Under deregulation, policies covering direct damage to building structures as well as similar products such as homeowner's personal property coverage are well suited for cross-selling because they can be bundled easily with the loan or mortgage.

Insurance Regulation before July 1994

The establishment of a federal regulatory authority[2] in Germany dates back to 1901 when the federal regulatory law went into force.[3] The German regulatory law is based on the principal that insurance regulation has to protect the interests of the insured, hence, requires prior approval of insurance contract terms by the Federal Insurance Authority. The Insurance Authority had considerable discretion in the approval of contract terms and took the position that insurance contracts should be uniform across insurance companies. The so called "principal of uniformity" results from the point of view that market transparency is a necessary condition to ensure the interests of the insured. The crucial philosophical assumptions underlying the argument are that first, an ordinary consumer is not capable of comparing different insurance contracts and making a rational buying decision. Second, insurance regulation has to protect consumers from buying inadequate insurance coverage. Therefore, all insurance products should have a minimum quality and as little variation in contract terms as possible. In such a "transparent market" consumers can rely on the quality of the products, and only have to compare the prices. To achieve uniformity, the Insurance Authority declares certain contracts as standard. Contract terms deviating from the standard do not have a chance of getting approval unless the Insurance Authority believes this deviation stands for real progress (Angerer, 1985). It is a corollary of this line of thought that new contracts deviating from the standard should not be approved for individual insurers. Rather, the standard itself should be revised and improved. Approval of the standard contract terms for use by individual insurers is only a matter of routine because the Insurance Authority usually publishes approved contract terms (Eggerstedt, 1987). This provides a strong incentive to use standard contract terms because it is not possible to gain a competitive advantage through the development of a new product.

All German insurers belong to associations that are organized according to the types of insurance business. These associations play an important role in the pricing of insurance coverage. They collect loss data from their members and generate aggregated statistics. But they also calculate rates which are based on these aggregated statistics, and recommend these rates to be used by their members. Such rate recommendations are possible because §102 of the German Cartel Law exempts insurers from most antitrust regulation.

[2] Kaiserliches Aufsichtsamt für Privatversicherung, later named Reichsaufsichtsamt für Privatversicherung. After World War II the occupation forces created supervisory agencies. In 1951 the new Bundesaufsichtsamt für das Versicherungswesen (BAV) was established. Since many staff members of the old Reichsaufsichtsamt worked for the British Zone agency, and the BAV took over most of their staff, there was some continuity in regulation (Kimball and Pfennigstorf, 1965).

[3] Reichsgesetzt über die private Versicherungsunternehmung, May 12, 1901, in: Reichsgesetzblatt 139. Today's Gesetz über die Beaufsichtigung der Versicherungsunternehmen (or Versicherungsaufsichtsgesetz) is based on this law with only modest changes.

In summary, in personal lines, which accounted for over 70% of the overall premiums written in 1990, there was almost no product competition. In fact, the environment in personal lines provided strong incentives for collusion in pricing. The situation in large commercial lines was less restrictive, but these lines did account for less than 30% of the market. Overall, the behaviour of German insurance companies before the deregulation can be described as a convoy led by the Insurance Authority and the associations (Farny, 1999). Therefore, management activity focused on the distribution system, marketing activity, customer service, and the improvement of business processes rather than on cost reduction.

Deregulation of the Insurance Industry

The deregulation of the German insurance industry is a result of the creation of the European Single Market. Since the founding of the European Community (EC) in 1957, its member states had been working on the creation of an integrated economic market. The framework for a single European insurance market was finally completed in July 1994. The accompanying harmonization of regulatory systems was designed to create a level playing field for all insurance companies within the European Union (EU).

The most profound regulatory change came in 1994. Since then, insurance companies only need a single license from their state of origin to write all types of insurance business in all member states of the EU, and they are only subject to regulation in their state of origin. Since the insurance contract law and the tax law of the host country still apply, insurers have to develop different products for different countries, making cross-border services difficult. Thus, the market share of cross-border business from European insurers in Germany is negligible. It was only 0.9% in 2003.[4] Even the market share of European insurers establishing branches in Germany is very small (1.5% in 2003) indicating that the creation of the European single market did not increase the competition significantly. But two side effect of the single market, the requirement that all member states abolished prior approval of insurance contract terms and rates as well as all monopoly authorizations, changed the German insurance market dramatically. These changes can be tied to July 29, 1994, the date when the legislation incorporating the third non-life insurance directive into German law went into effect. The deregulation of insurance contract terms and rates resulted in product and price competition among the insurers licensed in Germany and oper-

[4] Data on market shares is from the 2005 yearbook of the insurance supervisory authority (BaFin).

ating under the German regulatory regime. For public insurance companies, the fall of their monopoly authorization further increased the competitive pressure.

Effects of the German Reunification on the Insurance Industry

In addition to the deregulation of the German insurance market on July 29, 1994, the German Reunification on October 3, 1990 also changed the operating environment for German insurance companies. In the former German Democratic Republic there was a strong social security system but hardly any private insurance. The *Staatliche Versicherung der DDR* was the only insurance company in operation. This insurance company offered a wide variety of products ranging from homeowners, liability, life, accident and auto insurance to health insurance for self-employed professionals. However, most individuals relied more on the social security system then on private insurance solutions, and the ones who purchased private insurance had relatively low policy limits as measured by West German standards.[5]

As the five reestablished states of East Germany - Brandenburg, Mecklenburg-Vorpommern, Saxony, Saxony-Anhalt and Thuringia - formally joined the Federal Republic of Germany on October 3, 1990 all insurance companies licensed in West Germany could also offer their products in these new states. In the years 1991-1994 the German insurance market was still heavily regulated, hence, the German Reunification basically increased the market for the standardized German insurance products over night which resulted in tremendous growth for the insurance industry.

3. Hypothesis Development

The following section states our hypotheses about the relationship between the organizational form of insurance companies and their efficiency. Our analysis focuses explicitly on the mediating effect insurance regulation has on this relationship. Existing theoretical and empirical research on organizational forms assumes a competitive market environment. We extend this literature developing a framework that explains the relative advantage one organizational form has over another in a strictly regulated insurance market.

[5] After the Reunification, the largest German insurance company, the *Allianz AG*, bought the insurance portfolio of the *Staatliche Versicherung der DDR*.

H1: Regulatory Hypothesis

Regulation has a mediating effect on the relationship between the organizational structure of an insurance company and its efficiency.

Demsetz and Lehn (1985) suggest that regulation "provides some subsidized monitoring and disciplining of the management of regulated firms."[6] We modify Demsetz and Lehn (1985) and argue that the regulatory environment restricts the way insurance companies can conduct business, hence, influences the goals of the owners, managers and policyholders of these companies. We extend the literature and suggest that the comparative advantages of different organizational forms depend on the regulatory environment.

H2a: Expense Preference Hypothesis A

In a competitive market environment, mutual insurers are less successful in minimizing costs than stock insurers because of the unresolved agency conflicts.

We extend the well known *expense preference hypothesis*, to public insurance companies. Because the mutual form does not provide powerful mechanisms to control the owner-manager conflict, manager can get away with the consumption of perquisites increasing the company's expenses. Public insurance companies on the other hand are founded as non-profit organizations with the purpose to serve a certain region or administrative district. This goal may conflict with the economic goal to minimize costs in the production of insurance coverage from time to time. Boycko, Shleifer and Vishny (1996), for example, argue that due to the influence of politicians, public firms employ excess labor.

H2b: Expense Preference Hypothesis B

In a competitive market environment, public insurers are less successful in minimizing costs than stock insurers because of their objective to serve a region.

H2c: Expense Preference Hypothesis C

In a strictly regulated market environment without incentives for cost minimization, stock insurance companies are not more successful in minimizing costs than any other organizational form.

[6] Demsetz and Lehn (1985) focus their discussions on the relation between the regulation and ownership concentration.

The literature has applied the DEA to examine the organizational structure and efficiency. Cummins et al. (2004) propose the *efficient structure hypothesis* and state that different organizational forms are sorted into market segments where they have comparative advantages in agency and production costs. This argument does not only apply to stock and mutual insurance companies but also to public insurers. Hence:

H3a: Efficient Structure Hypothesis A

In a competitive market environment, stock, mutual and public insurers are sorted into market segments where they have comparative advantages in agency and production costs.

Since the basic economic principle that corporations or individuals divide labor based on their competencies applies to strictly regulated markets as well, we argue that the efficient structure hypothesis is valid unaltered in a regulated insurance market as well. Hence:

H3b: Efficient Structure Hypothesis B

In a strictly regulated market environment, stock, mutual and public insurers are sorted into market segments where they have comparative advantages in agency and production costs.

Because the stock ownership form makes it possible for owners to control managers effectively, stock insurers have comparative advantages in lines of insurance business where high level of managerial discretion is required. Mayers and Smith (1988) refer to this argument as the *managerial discretion hypothesis*. In addition, the *maturity hypothesis* states that mutual companies are relatively successful in business lines with lengthy claim settlement lags, because the owners' incentive to exploit policyholder interests is removed by merging the owner and policyholder function. However, insurance regulation might limit the degree of discretion managers have quite substantially. Hence:

H4a: Managerial Discretion Hypothesis A

In a competitive market environment, stock insurers have comparative advantages in short-tail lines of business where a high level of managerial discretion is required.

H4b: Managerial Discretion Hypothesis B

If insurance regulation restricts managerial discretion, stock insurers do not have comparative advantages in short-tail lines of business where a high level of managerial discretion is required**.**

Public insurers in Germany were founded as non-profit organizations with the purpose to serve a certain region or administrative district and were equipped with monopoly authorization in the compulsory building insurance line for their district. However, they also offered other insurance products we hypothesize that public insurers have comparative advantages in the compulsory business line in a regulated environment. We refer to this hypothesis as the *compulsory monopoly hypothesis*. Hence:

H5: Compulsory Monopoly Hypothesis

If public insurance companies have monopoly authorization for a compulsory business line, they have a comparative advantage in this business line.

After the deregulation of the German insurance market the German states sold their shares in the public insurers to the municipal savings banks. Since municipal savings banks are one of the major providers of corporate loans and mortgages in Germany, public insurers should benefit from this alliance by selling products in lines with relations to the banking business. Specifically, we expect that policies covering direct damage to building structures as well as similar products such as homeowner's personal property coverage are well suited for cross-selling because they can be bundled easily with a loan or mortgage. Hence:

H6: Public financial conglomerate hypothesis

If public insurance companies and municipal savings banks form a financial conglomerate public insurers have a comparative advantage in lines with relations to the banking business.

4. Data and Methodology

4.1 Data

In our assessment of the German insurers, we use company level data of property-liability insurance companies supervised by the German insurance authority (BaFin). We restrict our analysis to insurance companies which have gross premiums written of at least 50 million Euros per year for the years 1988-2005. The data for the insurers in our sample is obtained from their annual reports. There are 40 insurance companies in our sample, and these insurance companies account for an average of 55% of the overall written premium volume of the German property-liability insurance market. The final sample includes 26 stock, 8 mutual, and 6 public insurers in each year of the sample period. Thus, we have 720 firm observations over the whole sample period.

Table 1 presents yearly growth rates of premiums written, total invested assets, losses incurred and total assets for the insurance companies in our sample. All growth rates are significantly higher for the 1991 through 1994 period than for the time periods before 1991 and after 1994. In October 1990 the German Reunification occurred and in July 1994 the German insurance market was deregulated. Thus, in the years between these two events, the German insurance market was still heavily regulated, but experienced tremendous growth.

[Table 1: Yearly Growth Rates of Selected Variables]

Table 2 presents yearly premium growth rates for the three organizational forms: stock insurers, mutual insurers and public insurers. For the years 1991 through 1994, premium growth varies substantially across organizational forms; growth rates are highest for stock insurers and lowest for public insurers.

[Table 2: Differences in Premium Growth Rates across Organizational Forms]

Overall, these results indicate that the German Reunification had a substantial impact on the German insurance industry. It is therefore important to control for this effect in our analysis how regulation affects the comparative advantages of different organizational forms. To address this issue, we analyze the three time periods before 1991, 1991 through 1994 and after 1994, separately, and carefully interpret the results.

4.2 Methodology

In our analysis we follow the non-parametric Data Envelopment Analysis (DEA) approach of Cummins, Weiss and Zi (1999). This approach based on the work of Farrell (1957) and Fähe, Grosskopf, and Lovell (1985). More precisely, we apply the input oriented DEA and differentiate between the technical efficiency (TE), the allocative efficiency (AE), and the cost efficiency (CE) of each firm. While TE expresses the effectiveness with which a given set of inputs is used to produce a maximum output, AE expresses the effectiveness of the allocation of inputs given the prices of the inputs. CE reflects the combination of TE and AE, which means that a firm adopts the best technology (TE) and chooses the optimal input mix (AE) (Coelli, 1996).

Technical, Allocative and Cost Efficiency

To illustrate the efficiency measurement in a simple way Figure 1 shows a production frontier with two inputs (x_1 and x_2) and one output (y). We are using an input-oriented DEA; in this case the isoquant SS' characterizes the multiple combinations of the two inputs producing a fixed output. A firm operates technical efficiently with the best available technology if it is located on the isoquant, e.g. point Q. Technically inefficiency is presented in the input-combination of point P. The ratio QP/0P symbolizes the percentage of input reduction of one firm if this firm adopts the best technology. The TE is characterizes by

$$TE = 0Q/0P,$$

which is the inversion of 1 minus QP/0P. The value of the TE ranges from zero to one. One indicates fully efficiency.

[Figure 1: Technical Efficiency]

The ratio of input prices is presented by the isocost line AA' shown in Figure 1. A firm operates allocative efficiently with the optimal input mix if it is located on the isocost line, e.g. point R. So AE is represented by the ratio

$$AE = 0R/0Q.$$

The optimal operating point is represented in point Q', where the isoquant is tangent the isocost line. On this point the operating firm is fully cost efficient. CE is defined as the ratio:

$$CE = 0R/0P.$$

Cost Efficiency is then defined as the product of TE and AE:

Cost Efficiency = Technical Efficiency × Allocative Efficiency

or

$$0R/0P = (0Q/0P) \times (0R/0Q). \quad (1)$$

Cost efficiency is estimated by solving linear programming problems. The first step is to calculate the minimum cost, MC, of producing the output of a particular firm. Specifically, for the multiple input–output situations the following LP problem is solved:

$$\begin{aligned} \text{Minimize:} \quad & px_i^* \\ \text{Subject to:} \quad & y_i \leq \lambda Y \\ & x_i \leq \lambda X \\ & \lambda \in R_+. \end{aligned} \quad (2)$$

In this problem, y is the m-dimensional vector of output produced by a particular firm; x_i is the n-dimensional vector of inputs used by a particular firm; Y is the (k × m) matrix of outputs where k represents the number of firms; X is the (k × n) matrix of inputs; λ is a (m × 1) vector of intensity parameters or weights attached to each observations in the determination of minimum cost; and p is the n-dimensional vector of input prices. The input values generated by the solution to the above problem $\left(x_i^*\right)$ represent the minimum cost vector of input for the i-th firm. The total CE of i-th firm would then be calculated as:

$$CE = px_i^* / px_i,$$

which is the ratio of minimum cost to observed cost. This ratio corresponds to 0R/0P in Figure 1.

A measure of TE is also developed using a second LP problem. The LP problem is stated as:

$$\begin{aligned} \text{Minimize:} \quad & TE \\ \text{Subject to:} \quad & y_i \leq \lambda Y \\ & TE * x_i \leq \lambda X \\ & \lambda \in R_+. \end{aligned} \quad (3)$$

In this problem, TE is a scalar with all of the other symbols as defined previously. For instance, in Figure 1 TE of point P responds to 0Q/0P. After TE and CE are calculated, AE is derived through Equation (1) as AE = CE/TE.

Cross-Frontier Distance Function

In this section, we review an approach called "cross-frontier efficiency method" which was advanced by Cummins et al. (1999) comparing mutual and stock insurers. Through the estimation of cross-frontier distance function, this approach allows us to compute the efficiency of the firms in each ownership group with reference to the other group's production or cost frontier. The purpose of this approach is to help us examine whether each group's output vector could be produced with equal efficiency using the other group's technology.

We begin our discussion of cross-frontier distance function with the introduction of input-oriented distance function (Shephard, 1970). To illustrate the distance function, consider the firm operating at point (x_m,y_m) in Figure 2. Although x_m represents input of the mutual firm m, y_m represents the output of the firm m in period t, and V_m and V_s are the frontiers of mutual firm m and stock firm s, respectively. Subscripts on D in the following distance functions indicate the reference set of firms used to construct the frontier. For example, $D_m(x_m,y_m)$ denotes the production point (x_m,y_m) with respect to the mutual frontier V_m. The distance function value for this firm relative to the mutual frontier is given by $D_m(x_m,y_m) = 0e/0d$. One can see that the measure of Farrell's TE_m of point $(x_m,y_m) = 0d/0e$, which happens to be the reciprocal of the input distance function of the specific point. Although TE of a production point is always ≥ 1, input distance function value is always ≤ 1.

However, input distance function "relative to the other group's function" is not necessarily always ≥ 1. This is the so-called "cross-frontier" distance function, and we illustrate it using the example of input distance function of a mutual firm (x_m,y_m) relative to the stock frontier V_s, $D_s(x_m, y_m)$ in Figure 2. For the specific production point (x_m,y_m), the distance value with respect to the stock frontier V_s is 0d/0c, which is smaller than 1 as the stock frontier lies to the right of the point. It implies that this mutual firm has a technological advantage in producing in its output range. If the whole mutual group performs in the same way, it means the mutual firms are dominant in producing their outputs using their own technologies.

[Figure 2: Stock and Mutual Frontier]

Cross-to-Own Frontier Analysis

The measurement of the distance between the frontiers is possible at each operating point (see Figure 2). It is also probable to decompose a firm's group-specific frontier distance into: distance between frontiers × distance from the frontier relevant to the other group of firms. We follow Cummins et al. 2004 and use the notation $D_{T\{M:S\}}(x_m,y_m)$ to illustrate the distance between the production frontiers (symbolized by subscript T) with respect to the mutual firm's operating point (x_m,y_m), for stock insurers vice versa. We compute the mutual firm's distance function value relative to the mutual frontier:

$$D_m(x_m,y_m) = D_{T\{M:S\}}(x_m,y_m) \times D_s(x_m,y_m) = 0e0c/0d0d \times 0d/0c = 0e/0d \qquad (4)$$

This permits us to estimate the distance between the mutual and the stock frontier for each operating point by the product of the ratio of the own-frontier distance function to the cross-frontier distance function, i.e. $D_{T\{M:S\}}(x_m,y_m) = D_m(x_m,y_m) / D_s(x_m,y_m)$. This projects each firm's operating point to its own-frontier.

By using Farrells technical efficiency as the reciprocal of the distance function value, the cross-frontier can be expressed as the ratio of the cross-frontier technical efficiency to the own-group (own-frontier) technical efficiency: $D_{T\{M:S\}}(x_m,y_m) = T_s(x_m,y_m) / T_m(x_m,y_m)$ for mutual firms, and $D_{T\{S:M\}}(x_s,y_s) = T_m(x_s,y_s) / T_s(x_s,y_s)$ for stock insurers. On this account, we refer $D_{T\{M:S\}}(x_m,y_m)$ and $D_{T\{S:M\}}(x_s,y_s)$ as the cross-to-own-efficiency ratios. For allocative and cost efficiency analogous ratios are achieved. If that firm's group-specific frontier dominates the other group's frontier the distance between the frontiers for any given operating point is > 1 and < 1 if the other group's frontier dominates the firm's group-specific frontier.

Measuring Inputs, Outputs and Prices

Consistent to the recent insurance and banking literature, we adopt the well established value-added approach to measure property-liability insurers' outputs and inputs (Berger and Humphrey, 1992; Yuengert, 1993; Cummins, Tennyson, and Weiss, 1999).[7] For the DEA we used two outputs and three inputs.

Outputs

We select the present value of claims incurred net of reinsurance as one output variable. We also select total invested assets as a second output. Both outputs are deflated to the base year 2000 using the German Consumer Price Index (CPI).

Inputs

We classify insurance inputs into three different groups: labor and business services, equity capital, and dept capital. The operating expenses express the labor and business service compo-

[7] We did not use the financial intermediate approach for the reason that it is not appropriate for the property-liability insures because their services are not limited to financial intermediation, see Cummins, Weiss, Zi, 1999; Lai, Jeng, 2005.

nent including commissions and salaries. The input price is the average expense for insurance business services including average wages for commissions and salaries.

The second input factor is equity capital. Equity capital is measured by book value. As a second price measure we adopt the dept-equity ratio of the firm following Jeng, Lai, McNamara, 2007.

The final input is dept capital proxied by technical provisions net of reinsurance. The three years German Treasury Bills is the deflated input price for dept capital.

5. Results

5.1 Descriptive Statistics for Inputs, Outputs and Prices

Table 3 provides descriptive statistics for inputs, outputs and input prices for all insurers and the sub-samples of the three organizational forms: stock, mutual, and public insurers. Overall, the mean values for most variables are higher for stock insurance companies than for mutual and public insurers. The mean for the *equity capital* variable, however, is smaller for stock insurers than for mutual and public insurers. There are two possible explanations for this result. First, the stock insurers in our dataset write more business in short-tail lines than mutual and public insurers. Since losses in short-tail lines are *ceteris paribus* better predictable than losses in long-tail lines, stock insurers should on average hold less capital than mutual and publics insurers. Second, stock insurers have access to the capital market if their capital gets depleted. This option reduces their need to hold capital within the company.

[Table 3: Descriptive Statistics for Output and Input Variables]

5.2 Cross Efficiency Results

We follow the procedure of Cummins, Weiss and Zi (1999) and first test whether the three organizational forms have different production technologies. Comparing the insurance companies' efficiency scores based on the pooled efficiency frontier with efficiency scores based on group specific frontiers, we find significant differences of the group means for both, technical efficiency (TE) and cost efficiency (CE). These results indicate that the separated frontiers are significantly different from the pooled frontier. Thus, we can conclude that the pooled methodology is not appropriate for our dataset because stock, mutual and public insurers use different technologies and operate on different production frontiers.

We next analyse the cross frontier efficiencies, results are presented in Tables 4 and 5. We compute technical efficiency of the stock relative to the mutual frontier $T_m(x_s,y_s)$ and relative to the public frontier $T_p(x_s,y_s)$. We also conduct the same analysis for cost efficiency. Finally, we examine mutual and public efficiency relative to the other two frontiers. If the cross frontier results are greater than 1, this implies that it is not feasible to replicate one firms input-output combination using the other firms technology for producing the first firms output.

Table 4 shows the technical efficiency scores for the years 1988 through 2005. Let us first focus on the results for the 1988 through 1990 period. For all three years the mutual technical efficiency on the stock frontier $T_s(x_m,y_m)$ is greater than one and the stock technical efficiency on the mutual frontier $T_m(x_s,y_s)$ is greater than one as well. This implies that mutual insurers and stock insurers have developed dominant technologies and, hence stock (mutual) insurers are not able to produce the mutual (stock) insurer's output vector with equal efficiency. When comparing stock insurers with public insurers for the 1988 through 1990 time period, we find the same result; both organizational forms have a dominant technology to efficiently produce their own output vector. The comparison between the mutual insurers and the public insurers is not as clear. The mutual technical efficiency on the public frontier $T_p(x_m,y_m)$ is greater than one for all three years, but the public technical efficiency on the mutual frontier $T_m(x_p,y_p)$ is smaller than one. However, these values are relatively close to one – the smallest value is 0.97 – and, furthermore, the public efficiency score results relative to the mutual frontier are not significantly different from the corresponding efficiency score results relative to the public frontier. Therefore, we argue that there is no evidence for a dominance of the mutual production technology over the public technology. Overall the pair wise comparisons of the stock, mutual and public technical efficiencies provide support for the *efficient structure hypothesis* (H3b). All three organizational forms focus on market segments where they have a comparative advantage.

[Table 4: Technical Efficiency Score Results of Stock, Mutual and Public Insurers Input-Output-Combinations]

Let us now focus on the 1991 through 1994 time period. When comparing stock insurers with mutual insurers, we find that both organisational forms have developed dominant technologies and, hence, stock (mutual) insurers are not able to produce the mutual (stock) insurer's output vector with equal efficiency. The comparisons of stock insurers with public insurers and the comparison of mutual insurers with public insurers, however, provide a different result. For the years 1992 through 1994, the stock technology can produce the public output more efficiently than the public insurers' own technology and this result is significant at the one percent level in 1993. Similarly, for the years 1991 through 1994, the mutual technology can produce the public output more efficiently than the public insurers' own technology and this result is significant in three out of the four years. Thus, the public technology is inferior to the stock and mutual technology in the 1991 through 1994 period which can be characterized by tremendous growth opportunities in the territory of the former GDR after the German Reunification.

Let us now focus on the technical efficiency results for the time period after the deregulation of the German insurance market. When comparing stock insurers with mutual insurers for the years 1995 through 2005, we find that both organizational forms have a dominant technology to efficiently produce their own output vector, and it is not feasible for the other organizational form, on average, to replicate this output vector. Except for the years 1995 and 1998, we find the same result for the comparison between the stock and the public technology. Both, stocks and publics have a dominant technology for producing their own output vector and are, hence, efficient in their market segment. When comparing the mutual and the public technology for the years 1998 through 2005, we also find that both organizational forms efficiently produce their own output vector, and it is not feasible for the other organizational form, on average, to replicate this output vector. We attribute the fact that the mutual technology can produce the public output more efficiently than the public insurers' own technology in the years 1995 through 1997 to the German Reunification. Since public insurance companies were restricted to a certain region before the deregulation in 1994, they could not profit from the growth opportunities of the 1991 through 1994 time period. We now argue that it took them until 1998 to finally compensate this comparative disadvantage and re-establish their dominance in producing their output vector. Therefore, the findings for the 1995 through 2005 period support the *efficient structure hypothesis* (H3b).

Table 5 presents the cost efficiency scores for the years 1988 through 2005. Let us first focus on the results for the 1988 through 1990 period. Stock insurers are significantly less cost efficient and are, hence, dominated by mutual insurers in producing stock output as well as producing mutual output. In addition, stock insurers are less cost efficient and are dominated by public insurers in producing stock output and public output. These findings support the version of the *expense preference hypothesis* (H2c) for regulated markets. In an environment without incentives for cost minimization, stock insurers cannot use their strong mechanism to control the owner-manager conflict for creating a comparative advantage.

[Table 5: Cost Efficiency Score Results of Stock, Mutual and Public Insurers Input-Output-Combinations]

The time period after the German Reunification provides a different picture. For the years 1993 and 1994, it can be seen that stock insurers are more cost efficient compared to mutual insurers for producing stock as well as mutual input-output-combinations. Furthermore, stock insurers are more cost efficient and dominated public insurers in producing stock output as well as producing public output. We attribute the improved cost efficiency of stock insurers relative to the other two organizational forms to the faster growth of stock insurance companies after the Reunification.

Let us now focus on the cost efficiency results for the time period after the deregulation of the German insurance market. When comparing stock and mutual insurers, stock insurers are only more cost efficient in producing stock as well as mutual outputs for the four years 1998 through 2001. For the periods 1995 through 1997 and 2002 through 2005, stock insurers are more cost efficient in producing stock outputs, but mutual insurers are more cost efficient in producing mutual outputs. In addition, it is not feasible for stock insurers, on average, to replicate the mutual output vector for the years 2002 through 2005. Therefore, we conclude that our results do not support the *expense preference hypothesis A* (H2a). The comparison between stock and public insurance companies, however, supports the *expense preference hypothesis B* (H2b). Specifically, stock insurers are more cost efficient and dominate public insurers in producing stock output as well as producing public output.

5.3 Regression Results

To analyze the comparative advantages of the stock, mutual and public ownership forms by lines of business, we perform a regression analysis of the cross-to-own efficiency ratios for technical and cost efficiency. More precisely, for each pair of the three ownership forms, we regress the cross-to-own efficiency ratios on a set of independent variables representing the organizational form, size, business mix, and year fixed effects. Organizational form is captured by two dummy variables: The *stock* variable is coded as 1 for stock insurers and 0 otherwise, and the *mutual* variable is coded as 1 for mutual insurers and 0 otherwise. We include three size quartile dummy variables in the regression; the omitted first quartile is the smallest. The variable *LT%* represents the percentage of gross premiums written in long-tail lines, and the variable *BT%* represents the percentage of gross premiums written in business lines covering direct damage to building structures as well as similar products such as homeowner's personal property coverage. Interaction terms between the organizational form dummy variables and the business mix variables are also included in the models to allow the effects of organizational form to differ by line.

Table 6 presents the regression results for the 1988 through 1990 time period. The first two regressions compare the stock and mutual ownership forms. The comparative advantage of the two ownership forms by line of business is measured directly by the coefficient for the *LT% * stock* interaction term. This coefficient is positive and significant in both, the technical and the cost regression imply that stocks tend to have a comparative advantage in writing long-tail lines relative to short-tail lines, i.e., an increase in the fraction of business in long-tail lines tends to shift the stock frontier to the left of the mutual frontier (see Figure 2). This result contradicts the agency-theoretic argument that mutual insurers should have a comparative advantage in lines with longer claim settlement periods because a longer time period gives mutual managers more opportunities to exploit policyholder interests. But this finding is consistent with the view that a strict regulatory environment limits managerial discretion and specifically prevents stock managers from exploiting policyholder interests. Hence, the elimination of the owner-policyholder conflict should not give mutual insurers a comparative advantage over stock insurers in long-tail lines. Therefore, the positive and significant coefficient of the *LT% * stock* interaction term supports our *managerial discretion hypothesis B* (H4b).

[Table 6: Frontier Distance Regressions for the Years 1988 through 1990]

The second set of regressions in Table 6 compares the stock and public ownership forms. In both the technical and cost regressions including the *LT%* variable, the coefficient of the *LT% * stock* interaction term is positive and not significant. This result is consistent with the *managerial discretion hypothesis B* (H4b) which predicts that a strict regulatory environment prevents stock managers from exploiting policyholder interests in long-term lines. Hence, the reduction of the owner-policyholder conflict should not give public insurers a comparative advantage over stock insurers in long-term lines. In the regression model with the *BT%* variable, the coefficient of the *BT% * stock* interaction term is negative and significant. This indicates that stocks tend to have a comparative *dis*advantage or publics tend to have a comparative advantage in writing business lines covering direct damage to building structures as well as similar products such as home-owner's personal property coverage. Since insurance coverage for buildings was compulsory during the 1988 through 1990 time period and public insurers had monopoly authorization for these products, the results for both the technical and cost regression support the *compulsory monopoly hypothesis* (H5).

The third set of regressions in Table 6 compares the mutual and public ownership form. In the technical efficiency regression with the *BT%* variable, the coefficient of the *BT% * mutual* interaction term is negative and significant. This result indicates that mutual insurers tend to have a comparative *dis*advantage or public insurers tend to have a comparative advantage in writing "building" lines. Since public insurers had monopoly authorization for policies covering direct damage to buildings, this result supports the *compulsory monopoly hypothesis* (H5).

Table 7 presents the regression results for the 1991 through 1994 time period. A unique characteristic of this time period following the German Reunification is the tremendous growth of the insurance industry. However, not all companies were able to profit from this opportunity. Therefore, we include three additional variables into our models capturing the differences in premium growth rates between organisational forms. For each year, the *growth(i,j)* variable, *(i,j)* $\in$ *{(stock,mutual), (stock,public), (mutual,public)}* measures the difference in premium growth between the individual insurers of organizational form *i* and the mean growth rate of the organizational form *j*. A positive and significant coefficient for this variable in our regressions indicates that a higher premium growth improves the efficiency of one organizational form relative to the other organizational form under consideration. The cost efficiency regression comparing stock with mutual insurers has a positive and significant coefficient for the *growth(stock,mutual)* variable. Thus, we can conclude that the faster premium growth of stock insurers in the years following the Reunification improved their cost efficiency relative to mutual insurers. Similarly, the coefficient for the *growth(stock,public)* variable is positive and significant in the cost efficiency regression comparing stock and public insurers. Thus, we can conclude that the faster premium growth of stock insurers after the Reunification significantgly improved their cost efficiency relative to public insurers. We also find that the faster growth of mutual insurers relative to public insurers after the Reunification improved the mutual insurers' technical efficiency relative to the public benchmark; the coefficient of the *growth(mutual,public)* variable is positive and significant in the technical efficiency regression comparing mutual and public insurers.

[Table 7: Frontier Distance Regressions for the Years 1991 through 1994]

Table 8 presents the regression results for the time period after the deregulation of the German insurance market. The first two regressions compare the stock and mutual ownership forms. In the technical regression, the coefficient for the *LT% * stock* interaction term is negative and significant indicating that stocks tend to have a comparative *dis*advantage or mutuals tend to have a comparative advantage in writing long-tail lines relative to short-tail lines. This result supports the *managerial discretion hypothesis A* (H4a) which predicts that mutual insurers should have a comparative advantage in long-tail lines due to reduced agency costs. Similarly, the coefficient for the *LT% * stock* interaction term is negative and significant in the technical regression comparing stock and public insurance companies. Thus, stocks also tend to have a comparative *dis*advantage relative to public insurers in writing long-tail lines. This result is consistent with the argument that the owner-policyholder conflict is much stronger for stock insurers than for public insurers established as non-profit organizations serving the insurance needs of a certain region. However, the owner-policyholder conflict is not completely eliminated for public insurers. In the technical efficiency regression comparing publics with mutuals, the coefficient for the *LT% * mutual* interaction term is positive and significant indicating that mutual insurers have a comparative advantage relative to public insurers in writing long-tail business lines.

[Table 8: Frontier Distance Regressions for the Years 1995 through 2005]

With respect to the *financial conglomerate hypothesis* (H6), we find mixed results. On the one hand, the coefficient for the *BL% * mutual* interaction term is negative and significant in the technical regression comparing mutual and public insurers. This result indicates that public insurers have a comparative advantage relative to mutual insurers in business lines with relations to the banking business. But on the other hand, the coefficient for the *BL% * stock* interaction term is positive and significant in the technical regression comparing stock and public insurers. This positive coefficient indicates that stock insurers have a comparative advantage or public insurers have a comparative *dis*advantage relative to stock insurers in these business lines with relations to the banking business.

Our main hypotheses is that the regulatory regime determents the relative efficiency and therefore the comparative advantages of different organizational forms. In a competitive market environment stock companies are the most cost efficient ones. In a highly restrictive regulatory regime which does not provide incentives for cost minimization, however, this should be the other way around. Consistent to this hypothesis we find that stock insurers are less cost efficient in the regulated environment and are dominated by mutual and public insurers. Furthermore, agency theory predicts that mutual insurers should have a comparative advantage in lines with longer claim settlement periods because a longer time period gives stock managers more opportunities to exploit policyholder interests. But a strict regulatory environment which limits managerial discretion should prevent stock managers from exploiting policyholder interests. Consistent with this hypothesis we find that stock insurance companies do not have a comparative *dis*-advantage in long-tail lines in the German insurance market before its deregulation.

6. Conclusion

This study examines the relation between efficiency and organizational structure in the insurance industry. In addition, we also investigate the effect of the regulatory framework on the relative efficiency of alternative organizational forms in the insurance industry. We test our hypothesis using the data from the German property-liability insurance industry.

The reasons we choose the German property-liability insurance industry as our sample are stated below. First, the German property-liability insurance industry is different from the U.S. in that there exists one special type of organizational form, public insurance companies, in the German property-liability insurance industry. More important, pubic insurers were founded as non-profit organizations with the purpose to serve a certain region or administrative district and were equipped with monopoly authorization for a compulsory business line for their district before 1994. We hypothesize that public insurers are more cost efficient then stock insurers if they have monopoly authorization for a compulsory business line. We refer to this hypothesis as the *compulsory monopoly hypothesis*.

Our analysis provides two main results: First, the results are consistent with our hypotheses that regulation influences comparative advantages of organizational forms. Specifically, we find that the stock cost frontier does not dominate the cost frontiers of the other organizational forms during the period when regulation was very strict. More important, we find that the public cost frontier dominates the stock cost frontier for this time period. This result is striking because it is not consistent with the *expenses preference hypothesis*. The finding is consistent with the *compulsory monopoly hypothesis*. We attribute these findings to the monopoly of public insurers in the compulsory building insurance line which existed until July, 1994 because of regulation. Second, consistent with the *expense preference hypothesis*, the stock cost frontier dominates the public cost frontier after the deregulation (1994). In other words, the expense hypothesis is supported by our evidence after the deregulation. The first two results imply that regulation plays an important role for efficiency.

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Figure 1: Technical Efficiency

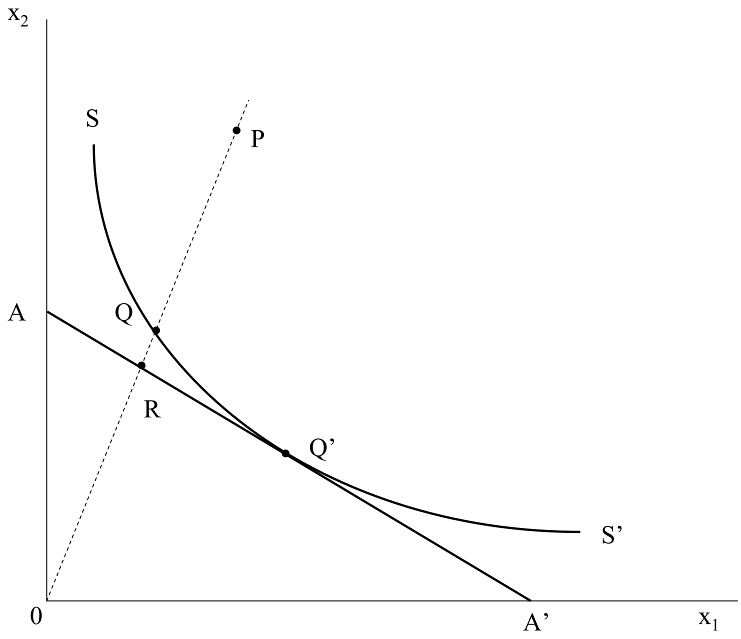

Figure 2: Stock and Mutual Frontier

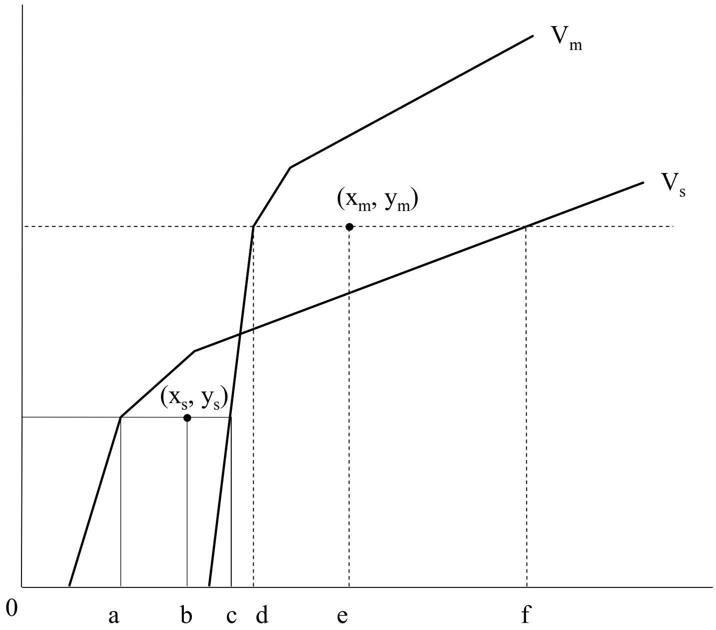

Table 1: Yearly Growth Rates of Selected Variables

Year	Premium growth	Growth in total invested assets	Growth in losses incurred	Growth in total assets
1989	9.37	12.51	9.61	13.16
1990	8.24	9.58	9.59	8.40
1991	18.01	10.23	19.73	11.58
1992	14.60	15.21	27.02	15.58
1993	11.83	14.95	14.58	14.10
1994	12.10	18.12	10.50	16.06
1995	4.29	12.99	5.84	11.71
1996	2.46	11.20	1.81	10.61
1997	9.43	9.06	2.78	8.02
1998	0.19	6.54	-0.88	6.79
1999	3.46	6.72	4.77	8.63
2000	11.81	7.37	9.99	7.83
2001	5.81	5.78	7.08	6.13
2002	7.16	4.56	10.13	6.64
2003	4.88	5.34	11.63	3.67
2004	1.71	9.50	1.66	5.91
2005	7.68	8.71	10.87	6.98
Difference:				
1988-1990 vs. 1991-1994	5.33***	3.58**	8.63**	3.55***
1991-1994 vs. 1995-2005	-10.19***	-6.65***	-13.83***	-6.79***

Note: All growth rates are reported in percent. Statistical significance of difference in means is based on a t-test. ***, **, and * denotes statistical significance at the 1, 5, and 10 percent level, respectively.

Table 2: Differences in Premium Growth Rates across Organizational Forms

Year	Stock	Mutual	Public	Differences of mean growth rates	
				Stock vs. others	Public vs. others
1989	9.28	10.32	8.53	-0.27	-0.99
1990	8.23	8.33	8.18	-0.04	-0.07
1991	19.54	16.88	12.84	4.39*	-6.08***
1992	15.87	13.40	10.71	3.62**	-4.58***
1993	12.19	11.66	10.53	1.01	-1.53*
1994	11.69	13.62	11.87	-1.19	-0.27
1995	3.75	6.31	3.92	-1.54	-0.43
1996	2.81	1.50	2.24	0.99	-0.26
1997	0.66	1.51	1.43	-0.82	0.57
1998	0.89	-1.50	-0.59	-0.22	-0.26
1999	4.83	1.79	-0.27	3.92**	-3.84***
2000	16.92	2.47	2.15	14.59	-11.37
2001	6.12	5.48	4.95	0.87	-1.02
2002	8.33	4.23	6.00	3.35	-1.39
2003	4.80	5.76	4.05	-0.22	-0.98
2004	0.44	4.66	3.24	-3.61	1.81
2005	-0.41	3.68	2.00	-2.54	1.45
1991-1994	14.82	13.89	11.49	1.96*	-3.11***

Note: Average premium growth rates are reported in percent. Statistical significance of difference in means is based on a t-test. ***, **, and * denotes statistical significance at the 1, 5, and 10 percent level, respectively.

Table 3: Descriptive Statistics for Output and Input Variables

	1988-1990				1991-1994				1995-2005			
	All	Stock	Mutual	Public	All	Stock	Mutual	Public	All	Stock	Mutual	Public
Premiums written	334.09	360.90	266.67	307.81	504.16	551.82	394.82	443.44	753.97	875.55	544.45	584.49
	(469.0)	(556.5)	(262.1)	(183.4)	(689.4)	(818.8)	(367.0)	(265.5)	(1,156.2)	(1,389.7)	(483.6)	(333.8)
Outputs												
Claims incurred net of reinsurance	183.17	183.32	182.95	182.78	286.01	290.70	277.11	277.54	436.58	472.66	382.80	351.95
	(251.8)	(287.7)	(204.2)	(111.9)	(383.1)	(441.5)	(290.0)	(167.1)	(625.2)	(738.1)	(383.3)	(193.5)
Total invested assets	458.55	469.81	415.54	467.12	646.24	658.29	603.56	650.90	1,398.94	1,501.95	1,261.57	1,135.71
	(697.0)	(827.9)	(392.7)	(289.4)	(999.3)	(1,186.6)	(569.0)	(396.8)	(2,468.9)	(2,960.5)	(1,256.0)	(695.2)
Inputs												
Operating expenses	64.31	73.36	37.20	61.27	100.43	114.36	61.72	91.67	158.31	188.99	89.18	117.53
	(78.4)	(92.3)	(28.7)	(44.1)	(119.6)	(141.0)	(47.0)	(62.2)	(225.6)	(269.4)	(74.5)	(76.2)
Equity Capital	95.66	87.43	99.45	126.28	138.67	124.21	154.87	179.74	275.98	229.23	403.66	308.33
	(115.3)	(130.4)	(81.9)	(75.0)	(165.2)	(181.7)	(138.0)	(110.3)	(367.6)	(358.0)	(462.0)	(179.8)
Debt proxied by technical provisions net of reinsurance	308.82	339.68	256.30	245.08	447.20	500.34	354.50	340.52	1,019.08	1,181.48	725.49	706.79
	(550.0)	(660.4)	(280.6)	(150.8)	(790.6)	(951.9)	(373.8)	(194.8)	(1,853.2)	(2,237.7)	(738.2)	(421.6)
Input prices												
Average expenses for insurance business services	0.56	0.56	0.56	0.56	0.74	0.74	0.74	0.74	1.13	1.13	1.13	1.13
	(0.0)	(0.0)	(0.0)	(0.0)	(0.1)	(0.1)	(0.1)	(0.1)	(0.2)	(0.2)	(0.2)	(0.2)
Dept to equity ratio	2.79	3.06	2.56	1.93	2.99	3.37	2.51	1.97	4.84	6.15	2.48	2.40
	(1.2)	(1.3)	(0.8)	(0.4)	(1.4)	(1.5)	(1.0)	(0.4)	(20.3)	(25.1)	(1.3)	(0.8)
German Treasury Bills (3 years)	5.60	5.60	5.60	5.60	6.38	6.38	6.38	6.38	4.27	4.27	4.27	4.27
	(1.5)	(1.5)	(1.5)	(1.5)	(1.0)	(1.0)	(1.0)	(1.0)	(0.8)	(0.8)	(0.8)	(0.8)
Number of firms	40	26	8	6	40	26	8	6	40	26	8	6
Number of Observations	120	78	24	18	160	104	32	24	440	286	88	66

Note: This table represents the mean values of inputs and outputs over the respective sample periods, 1988-1990, 1991-1994 and 1995-2005, for the sample of all insurers and the subsamples of stock, mutual and public insurers. Numbers in parentheses are standard deviations. All monetary variables are reported in millions of Euros and inflation adjusted with 2000 as the basis year.

Table 4: Technical Efficiency Score Results of Stock, Mutual and Public Insurers Input-Output-Combinations

Year	$T_s(x_s,y_s)$	$T_m(x_s,y_s)$	$T_p(x_s,y_s)$	$T_s(x_s,y_s)$ vs. $T_m(x_s,y_s)$	$T_s(x_s,y_s)$ vs. $T_p(x_s,y_s)$	$T_m(x_m,y_m)$	$T_s(x_m,y_m)$	$T_p(x_m,y_m)$	$T_m(x_m,y_m)$ vs. $T_s(x_m,y_m)$	$T_m(x_m,y_m)$ vs. $T_p(x_m,y_m)$	$T_p(x_p,y_p)$	$T_s(x_p,y_p)$	$T_m(x_p,y_p)$	$T_p(x_p,y_p)$ vs. $T_s(x_p,y_p)$	$T_p(x_p,y_p)$ vs. $T_m(x_p,y_p)$
1988	0.9693	1.0658	1.1904	**	**	0.9566	1.43125	1.3813	**	**	0.9928	1.1933	0.9700	**	
	(0.048)	(0.246)	(0.532)			(0.058)	(0.552)	(0.406)			(0.013)	(0.132)	(0.079)		
1989	0.9525	1.1265	1.2635	**	*	0.9574	1.3700	1.3259	**	**	0.9738	1.1417	0.9783	**	
	(0.058)	(0.434)	(0.921)			(0.059)	(0.527)	(0.421)			(0.041)	(0.130)	(0.105)		
1990	0.9561	1.3831	1.4535			0.9463	1.2475	1.3638	**	**	0.9782	1.0417	0.9717	**	
	(0.054)	(1.765)	(1.756)			(0.074)	(0.336)	(0.521)			(0.034)	(0.083)	(0.117)		
1991	0.9418	1.0242	1.1938		***	0.9425	1.1738	1.3800	***	***	0.9902	1.0067	0.9133		**
	(0.065)	(0.339)	(0.459)			(0.084)	(0.225)	(0.387)			(0.024)	(0.091)	(0.075)		
1992	0.9209	1.0558	1.3112		**	0.9690	1.1550	1.4750	**	***	0.9753	0.9600	0.9283		*
	(0.091)	(0.439)	(0.906)			(0.043)	(0.248)	(0.352)			(0.041)	(0.097)	(0.077)		
1993	0.7627	1.2092	1.6385	***	***	0.9703	0.8013	1.6188	***	**	0.9993	0.6767	0.9333	***	*
	(0.140)	(0.600)	(1.443)			(0.041)	(0.149)	(0.590)			(0.002)	(0.108)	(0.079)		
1994	0.9017	1.0542	1.2723	***	***	0.9695	1.1763	1.5325		**	0.9947	0.8817	0.9367		
	(0.098)	(0.294)	(0.361)			(0.050)	(0.407)	(0.643)			(0.013)	(0.158)	(0.088)		
1995	0.9013	1.1481	1.3335	***	***	0.9789	1.2600	1.4600		**	1.0000	0.9233	0.9550		
	(0.084)	(0.326)	(0.369)			(0.039)	(0.487)	(0.536)			(0.000)	(0.153)	(0.074)		
1996	0.9204	1.1904	1.3323	***	***	0.9916	1.4450	1.4013		**	1.0000	1.0733	0.9950		
	(0.062)	(0.399)	(0.436)			(0.019)	(0.802)	(0.457)			(0.000)	(0.284)	(0.097)		
1997	0.9207	1.2415	1.4685	***	***	0.9914	1.3613	1.4925		*	0.9975	1.0133	0.9950		
	(0.070)	(0.402)	(0.530)			(0.018)	(0.718)	(0.701)			(0.004)	(0.142)	(0.094)		
1998	0.9299	1.2369	1.5158	***	***	0.9865	1.2275	1.5063		*	0.9977	0.9867	1.0317		
	(0.070)	(0.344)	(0.469)			(0.025)	(0.494)	(0.656)			(0.006)	(0.124)	(0.097)		
1999	0.9002	1.1896	1.4162	***	***	0.9891	1.3125	1.4250		*	0.9953	1.0100	1.0433		
	(0.091)	(0.281)	(0.407)			(0.031)	(0.799)	(0.625)			(0.011)	(0.202)	(0.133)		
2000	0.8391	1.1815	1.4681	***	***	0.9906	1.4900	1.4450		**	0.9970	1.0517	1.0383		
	(0.103)	(0.310)	(0.483)			(0.027)	(1.250)	(0.524)			(0.007)	(0.412)	(0.162)		
2001	0.8541	1.2377	1.5908	***	***	0.9894	2.0163	1.5313		*	1.0000	1.1833	1.1267		
	(0.112)	(0.372)	(0.642)			(0.030)	(2.180)	(0.713)			(0.000)	(0.534)	(0.218)		
2002	0.8949	1.2915	1.5723	***	***	1.0000	1.8038	1.4600		**	0.9955	1.1683	1.0683		
	(0.093)	(0.431)	(0.700)			(0.000)	(1.423)	(0.424)			(0.011)	(0.505)	(0.194)		
2003	0.9293	1.1758	1.5088	***	***	0.9924	1.8013	1.4925		**	1.0000	1.2133	1.0917		
	(0.066)	(0.312)	(0.628)			(0.022)	(1.396)	(0.532)			(0.000)	(0.369)	(0.233)		
2004	0.9253	1.1696	1.5281	***	***	0.9881	1.8900	1.5375		**	1.0000	1.2350	1.1050		
	(0.071)	(0.374)	(0.791)			(0.024)	(1.704)	(0.571)			(0.000)	(0.486)	(0.283)		
2005	0.9161	1.2565	1.5088	***	***	0.9910	1.9550	1.5463		*	1.0000	1.2350	1.1417		
	(0.076)	(0.465)	(0.656)			(0.025)	(1.874)	(0.756)			(0.000)	(0.390)	(0.277)		

Note: T_i = Technical Efficiency for cross frontier (reference set) i. i = s = stock frontier, i = m = mutual frontier, i = p = public frontier. X_s,Y_s = input and output for stock firms. X_m,Y_m = input and output for mutual firms. X_p,Y_p = input and output for public firms. Statistical significance of difference in means is based on a t-test. ***, **, and * denotes statistical significance at the 1, 5, and 10 percent level, respectively. Numbers in parentheses are standard deviations.

Table 5: Cost Efficiency Score Results of Stock, Mutual and Public Insurers Input-Output-Combinations

Year	$C_s(x_s,y_s)$	$C_m(x_s,y_s)$	$C_p(x_s,y_s)$	$C_s(x_s,y_s)$ vs. $C_m(x_s,y_s)$	$C_s(x_s,y_s)$ vs. $C_p(x_s,y_s)$	$C_m(x_m,y_m)$	$C_s(x_m,y_m)$	$C_p(x_m,y_m)$	$C_m(x_m,y_m)$ vs. $C_s(x_m,y_m)$	$C_m(x_m,y_m)$ vs. $C_p(x_m,y_m)$	$C_p(x_p,y_p)$	$C_s(x_p,y_p)$	$C_m(x_p,y_p)$	$C_p(x_p,y_p)$ vs. $C_s(x_p,y_p)$	$C_p(x_p,y_p)$ vs. $C_m(x_p,y_p)$
1988	0.9188	0.8323	0.8723	***	***	0.8493	1.0088	0.9663	**	**	0.9358	1.0050	0.8550	***	**
	(0.067)	(0.082)	(0.095)			(0.099)	(0.217)	(0.203)			(0.068)	(0.073)	(0.134)		
1989	0.8880	0.8258	0.8650	***		0.8366	0.9800	0.9475	*	*	0.8987	0.9750	0.8333	***	*
	(0.084)	(0.121)	(0.143)			(0.111)	(0.240)	(0.235)			(0.099)	(0.102)	(0.166)		
1990	0.8716	0.8253	0.8612	**		0.8279	0.9588	0.9488	*		0.9310	0.9350	0.8533		*
	(0.081)	(0.145)	(0.111)			(0.117)	(0.245)	(0.276)			(0.085)	(0.093)	(0.160)		
1991	0.8022	0.7515	0.8404	***	***	0.7766	0.9313	0.9850	**	**	0.9165	0.8583	0.7800	***	***
	(0.099)	(0.124)	(0.147)			(0.151)	(0.240)	(0.290)			(0.087)	(0.097)	(0.130)		
1992	0.7783	0.7919	0.8546		***	0.8168	0.8975	0.9975		**	0.9258	0.8400	0.8033	***	***
	(0.114)	(0.152)	(0.160)			(0.123)	(0.235)	(0.285)			(0.083)	(0.086)	(0.133)		
1993	0.6531	0.8877	0.9362	***	***	0.8604	0.6875	1.0125	***	*	0.9200	0.6350	0.8483	***	**
	(0.153)	(0.205)	(0.226)			(0.101)	(0.130)	(0.248)			(0.095)	(0.098)	(0.119)		
1994	0.7311	0.8088	0.9096	***	***	0.8460	0.7800	1.0425	***	***	0.9170	0.7067	0.8150	***	***
	(0.123)	(0.131)	(0.189)			(0.115)	(0.148)	(0.238)			(0.081)	(0.099)	(0.106)		
1995	0.8309	0.8758	0.9935	***	***	0.9305	0.9363	1.1463		**	0.9863	0.8150	0.8617	***	***
	(0.095)	(0.117)	(0.140)			(0.078)	(0.143)	(0.209)			(0.019)	(0.041)	(0.074)		
1996	0.8598	0.8931	1.0154	***	***	0.9431	0.9813	1.1613		***	0.9830	0.8933	0.8750	***	**
	(0.079)	(0.107)	(0.164)			(0.060)	(0.190)	(0.191)			(0.022)	(0.045)	(0.077)		
1997	0.8750	0.9315	0.9912	***	***	0.9405	0.9813	1.0800		*	0.9700	0.8967	0.8950	***	*
	(0.074)	(0.120)	(0.136)			(0.055)	(0.165)	(0.185)			(0.046)	(0.044)	(0.076)		
1998	0.8705	0.9473	0.9942	***	***	0.9625	0.9288	1.0525		*	0.9697	0.8783	0.9200	***	
	(0.089)	(0.114)	(0.140)			(0.031)	(0.098)	(0.138)			(0.057)	(0.041)	(0.076)		
1999	0.8420	0.9796	1.0077	***	***	0.9604	0.9275	1.0188			0.9632	0.8950	0.9417	***	*
	(0.096)	(0.146)	(0.154)			(0.046)	(0.094)	(0.111)			(0.050)	(0.050)	(0.055)		
2000	0.7829	0.9696	0.9973	***	***	0.9619	0.9250	1.0650		*	0.9707	0.8567	0.9217	***	**
	(0.106)	(0.177)	(0.186)			(0.039)	(0.149)	(0.153)			(0.056)	(0.054)	(0.061)		
2001	0.7982	1.0496	1.0192	***	***	0.9806	0.9163	1.0625			0.9802	0.8483	0.9900	***	
	(0.103)	(0.197)	(0.170)			(0.032)	(0.139)	(0.160)			(0.044)	(0.047)	(0.097)		
2002	0.8375	1.0500	1.0435	***	***	0.9841	1.0500	1.1188			0.9517	0.8650	0.9533	***	
	(0.093)	(0.159)	(0.163)			(0.025)	(0.293)	(0.208)			(0.057)	(0.084)	(0.092)		
2003	0.8928	0.9719	1.0596	***	***	0.9786	1.0975	1.0700		*	0.9665	0.9633	0.9467		*
	(0.074)	(0.129)	(0.187)			(0.026)	(0.264)	(0.135)			(0.049)	(0.128)	(0.065)		
2004	0.8925	0.9677	1.0773	***	***	0.9615	1.0713	1.0963		**	0.9748	0.9350	0.9400		**
	(0.079)	(0.115)	(0.208)			(0.035)	(0.267)	(0.169)			(0.044)	(0.114)	(0.058)		
2005	0.8574	1.0062	1.0754	***	***	0.9625	1.0100	1.0625		*	0.9742	0.8850	0.9617	**	
	(0.088)	(0.149)	(0.205)			(0.038)	(0.266)	(0.146)			(0.044)	(0.106)	(0.064)		

Note: C_i = Cost Efficiency for cross frontier (reference set) i. i = s = stock frontier, i = m = mutual frontier, i = p = public frontier. X_s,Y_s = input and output for stock firms. X_m,Y_m = input and output for mutual firms. X_p,Y_p = input and output for public firms. Statistical significance of difference in means is based on a t-test. ***, **, and * denotes statistical significance at the 1, 5, and 10 percent level, respectively. Numbers in parentheses are standard deviations.

Table 6: Frontier Distance Regressions for the Years 1988 through 1990

	Stock vs. Mutual		Stock vs. Public				Mutual vs. Public			
			With LT%-Variable		With PL%- Variable		With LT%-Variable		With PL%- Variable	
	TE	CE	TE	CE	TE	CE	TE	CE	TE	CE
Intercept	0.934	1.433***	1.304	1.152***	1.150*	1.066***	1.140***	0.776***	0.520*	0.989***
	(1.34)	(18.36)	(1.19)	(17.91)	(1.67)	(27.60)	(2.76)	(4.38)	(1.70)	(8.36)
Size2	0.084	0.004	-0.101	-0.049**	0.060	-0.032*	0.381**	-0.026	0.342	-0.048
	(0.32)	(0.14)	(-0.31)	(-2.58)	(0.18)	(-1.72)	(2.08)	(-0.34)	(1.66)	(-0.60)
Size3	-0.024	-0.000	-0.257	-0.062***	-0.221	-0.053***	0.263	0.161*	0.067	0.188**
	(-0.09)	(-0.00)	(-0.85)	(-3.50)	(-0.73)	(-3.12)	(1.32)	(1.88)	(0.34)	(2.49)
Size4	-0.081	-0.030	-0.315	-0.084***	0.000	-0.065***	0.169	0.009	0.121	0.022
	(-0.32)	(-1.08)	(-1.09)	(-4.94)	(0.00)	(-3.72)	(0.95)	(0.12)	(0.64)	(0.30)
Stock	-0.998	-0.619***	-1.450	-0.197***	1.604**	-0.010				
	(-1.42)	(-7.87)	(-1.26)	(-2.92)	(2.13)	(-0.23)				
Mutual							-0.571	0.388	0.866***	0.076
							(-1.40)	(2.22)	(3.22)	(0.73)
LT%	0.507	-0.369***	-0.062	-0.080			-0.735	0.160		
	(0.62)	(-4.00)	(-0.03)	(-0.76)			(-1.18)	(0.60)		
LT% * Stock	1.654*	0.558***	2.820	0.158						
	(1.69)	(5.09)	(1.43)	(1.37)						
LT% * Mutual							1.557**	-0.256		
							(2.36)	(-0.91)		
BL%					-0.018	0.091			0.968	-0.423
					(-0.01)	(0.83)			(1.33)	(-1.50)
BL% * Stock					-8.338***	-0.479***				
					(-2.92)	(-2.99)				
BL% * Mutual									-2.435*	0.695
									(-1.80)	(1.33)
1989	0.057	0.015	0.088	0.023	0.026	0.020	0.005	-0.002	0.003	-0.004
	(0.26)	(0.61)	(0.37)	(1.61)	(0.11)	(1.47)	(0.05)	(-0.04)	(0.03)	(-0.09)
1990	0.230	0.024	0.219	0.018	0.140	0.014	0.011	-0.006	0.026	-0.011
	(1.06)	(0.97)	(0.91)	(1.25)	(0.58)	(1.07)	(0.10)	(-0.14)	(0.22)	(-0.25)
R^2	0.154	0.596	0.231	0.461	0.235	0.507	0.515	0.622	0.427	0.637
Adj. R^2	0.081	0.562	0.161	0.411	0.164	0.461	0.397	0.530	0.287	0.549
N	102	102	96	96	96	96	42	42	42	42

Note: The dependent variable is the cross-to-own-efficiency ratio. Size2 = 1 if insurer is in size quartile 2 (quartile 1 = smallest insurers), 0 otherwise; Size3 = 1 if insurer is in size quartile 3, 0 otherwise; Size4 = 1 if insurer is in size quartile 4, 0 otherwise; Stock = 1 if insurer is a stock insurer, 0 otherwise; Mutual = 1 if insurer is a mutual insurer, 0 otherwise; LT% = percentage of premiums in long-tail lines; BL% (Building-Lines) = percentage of premiums in the following three lines: fire, residential and commercial building damage, homeowner's personal property; 1989 and 1990 = year dummies for the years 1989 and 1990. Statistical significance of difference in means is based on a t-test. ***, **, and * denotes statistical significance at the 1, 5, and 10 percent level, respectively. Numbers in parentheses are standard deviations.

Table 7: Frontier Distance Regressions for the Years 1991 through 1994

	Stock vs. Mutual		Stock vs. Public				Mutual vs. Public			
			With LT%-Variable		With PL%- Variable		With LT%-Variable		With PL%- Variable	
	TE	CE	TE	CE	TE	CE	TE	CE	TE	CE
Intercept	0.948***	1.161***	1.764**	0.933***	0.518	0.804***	1.141***	0.625***	0.228	0.923***
	(3.65)	(8.45)	(2.41)	(5.45)	(1.10)	(7.41)	(2.78)	(4.11)	(0.75)	(8.94)
Size2	0.087	-0.029	0.060	-0.068	0.186	-0.010	0.541***	0.025	0.538**	-0.016
	(0.90)	(-0.56)	(0.26)	(-1.25)	(0.77)	(-0.18)	(2.76)	(0.35)	(2.40)	(-0.21)
Size3	-0.046	-0.018	-0.250	-0.045	-0.250	-0.014	0.393*	0.254***	0.165	0.255***
	(-0.47)	(-0.35)	(-1.24)	(-0.96)	(-1.25)	(-0.30)	(1.78)	(3.10)	(0.80)	(3.61)
Size4	-0.056	-0.014	-0.232	-0.075*	-0.046	-0.036	0.185	0.063	0.131	0.060
	(-0.64)	(-0.29)	(-1.21)	(-1.68)	(-0.23)	(-0.77)	(0.96)	(0.88)	(0.65)	(0.87)
Stock	-0.292	-0.091	-1.286	0.322*	2.123***	0.529***				
	(-1.13)	(-0.67)	(-1.64)	(1.75)	(4.01)	(4.33)				
Mutual							-0.558	0.532***	1.286***	0.181*
							(-1.36)	(3.50)	(4.62)	(1.91)
LT%	0.217	-0.194	-1.278	-0.079			-1.006	0.245		
	(0.69)	(-1.16)	(-1.03)	(-0.27)			(-1.67)	(1.09)		
LT% * Stock	0.829**	0.289	3.320**	0.081						
	(2.29)	(1.50)	(2.43)	(0.25)						
LT% * Mutual							1.925***	-0.282		
							(2.95)	(-1.16)		
BL%					1.408	0.140			1.484**	-0.492**
					(1.05)	(0.45)			(2.07)	(-2.01)
BL% * Stock					-7.994***	-0.783				
					(-3.89)	(-1.65)				
BL% * Mutual									-3.350**	0.927*
									(-2.16)	(1.76)
Growth(s,m)	-0.118	0.321*								
	(-0.33)	(1.72)								
Growth(s,p)			-0.417	0.303*	0.845	0.357**				
			(-0.57)	(1.78)	(1.18)	(2.15)				
Growth(m,p)							2.260**	0.029	2.259*	0.099
							(2.15)	(0.07)	(2.00)	(0.26)
R^2	0.210	0.099	0.281	0.465	0.288	0.483	0.607	0.764	0.559	0.777
Adj. R^2	0.167	0.050	0.239	0.434	0.246	0.452	0.549	0.729	0.495	0.745
N	136	136	128	128	128	128	56	56	56	56

Note: The dependent variable is the cross-to-own-efficiency ratio. Size2 = 1 if insurer is in size quartile 2 (quartile 1 = smallest insurers), 0 otherwise; Size3 = 1 if insurer is in size quartile 3, 0 otherwise; Size4 = 1 if insurer is in size quartile 4, 0 otherwise; Stock = 1 if insurer is a stock insurer, 0 otherwise; Mutual = 1 if insurer is a mutual insurer, 0 otherwise; LT% = percentage of premiums in long tail-lines; BL% (Building-Lines) = percentage of premiums in the following three lines: fire, residential and commercial building damage, homeowner's personal property; Growth(i,j) = difference in premium growth between one specific insurer of organizational form i and the mean growth rate of insurers from the organizational form j. Statistical significance of difference in means is based on a t-test. ***, **, and * denotes statistical significance at the 1, 5, and 10 percent level, respectively. Numbers in parentheses are standard deviations.

Table 8: Frontier Distance Regressions for the Years 1995 through 2005

	Stock vs. Mutual		Stock vs. Public				Mutual vs. Public			
			With LT%-Variable		With PL%- Variable		With LT%-Variable		With PL%- Variable	
	TE	CE	TE	CE	TE	CE	TE	CE	TE	CE
Intercept	0.412	1.187***	0.510	1.082***	1.738***	1.008***	0.678*	0.818***	0.939***	0.978***
	(1.11)	(16.47)	(1.52)	(14.35)	(8.29)	(21.15)	(1.80)	(8.15)	(3.86)	(14.04)
Size2	0.037	-0.118***	-0.044	-0.088***	-0.074	-0.086***	0.424**	-0.001	0.321*	-0.030
	(0.34)	(-5.48)	(-0.47)	(-4.16)	(-0.84)	(-4.30)	(2.20)	(-0.03)	(1.89)	(-0.61)
Size3	0.289***	-0.017	-0.161*	-0.108***	-0.163**	-0.109***	0.484**	0.143***	0.127	0.132***
	(2.60)	(-0.77)	(-1.93)	(-5.76)	(-2.01)	(-5.93)	(2.36)	(2.62)	(0.75)	(2.72)
Size4	-0.016	-0.106***	-0.010	-0.109***	-0.012	-0.109***	0.059	-0.006	-0.061	-0.005
	(-0.17)	(-5.53)	(-0.13)	(-6.30)	(-0.16)	(-6.42)	(0.31)	(-0.11)	(-0.35)	(-0.11)
Stock	0.926***	0.030	1.361***	0.250***	-0.239	0.263***				
	(2.60)	(0.43)	(3.96)	(3.23)	(-1.17)	(5.68)				
Mutual							-0.452	0.206**	0.996***	0.059
							(-1.25)	(2.14)	(5.72)	(1.19)
LT%	1.747***	-0.083	1.293**	-0.077			0.110	0.122		
	(3.64)	(-0.90)	(2.20)	(-0.59)			(0.20)	(0.85)		
LT% * Stock	-1.663***	0.094	-1.638***	0.017						
	(-3.20)	(0.94)	(-2.59)	(0.12)						
LT% * Mutual							1.321**	-0.046		
							(2.17)	(-0.29)		
BL%					-1.800***	0.110			0.147	-0.275**
					(-3.11)	(0.84)			(0.30)	(-1.98)
BL% * Stock					3.146***	0.093				
					(4.04)	(0.53)				
BL% * Mutual									-4.578***	0.738***
									(-5.48)	(3.09)
1995	-0.257	-0.101***	-0.183	-0.051*	-0.176	-0.050*	-0.087	0.043	-0.163	0.049
	(-1.58)	(-3.22)	(-1.46)	(-1.80)	(-1.43)	(-1.80)	(-0.55)	(1.01)	(-1.13)	(1.19)
1996	-0.193	-0.105***	-0.176	-0.049*	-0.177	-0.049*	-0.096	0.050	-0.149	0.052
	(-1.19)	(-3.36)	(-1.41)	(-1.73)	(-1.44)	(-1.76)	(-0.60)	(1.18)	(-1.04)	(1.26)
1997	-0.168	-0.085***	-0.070	-0.086***	-0.072	-0.086***	-0.034	0.019	-0.084	0.019
	(-1.03)	(-2.71)	(-0.56)	(-3.06)	(-0.58)	(-3.08)	(-0.21)	(0.45)	(-0.59)	(0.46)
1998	-0.207	-0.084***	-0.050	-0.081***	-0.049	-0.080***	0.002	-0.001	-0.040	-0.003
	(-1.28)	(-2.69)	(-0.41)	(-2.88)	(-0.40)	(-2.88)	(0.01)	(-0.02)	(-0.28)	(-0.08)
1999	-0.190	-0.025	-0.091	-0.030	-0.087	-0.029	-0.036	-0.007	-0.081	-0.010
	(-1.17)	(-0.80)	(-0.73)	(-1.07)	(-0.71)	(-1.05)	(-0.22)	(-0.18)	(-0.56)	(-0.26)
2000	-0.070	0.032	0.068	0.023	0.077	0.024	-0.059	-0.004	-0.085	-0.006
	(-0.43)	(1.03)	(0.55)	(0.81)	(0.63)	(0.87)	(-0.37)	(-0.09)	(-0.60)	(-0.16)
2001	0.078	0.087***	0.166	0.020	0.174	0.022	-0.006	0.008	-0.025	0.007
	(0.48)	(2.76)	(1.33)	(0.72)	(1.42)	(0.78)	(-0.04)	(0.19)	(-0.18)	(0.18)
2002	0.013	0.069**	0.076	0.000	0.087	0.002	-0.085	0.026	-0.084	0.025
	(0.08)	(2.19)	(0.61)	(0.00)	(0.71)	(0.05)	(-0.54)	(0.61)	(-0.59)	(0.62)
2003	-0.115	-0.047	-0.020	-0.035	-0.005	-0.033	-0.058	-0.010	-0.059	-0.009
	(-0.71)	(-1.49)	(-0.16)	(-1.26)	(-0.04)	(-1.17)	(-0.37)	(-0.23)	(-0.41)	(-0.23)
2004	-0.095	-0.052	0.003	-0.027	0.007	-0.026	-0.023	0.010	-0.026	0.010
	(-0.58)	(-1.65)	(0.02)	(-0.97)	(0.06)	(-0.93)	(-0.14)	(0.23)	(-0.18)	(0.25)
R^2	0.091	0.373	0.212	0.580	0.231	0.582	0.345	0.513	0.465	0.541
Adj. R^2	0.050	0.345	0.174	0.560	0.194	0.562	0.269	0.456	0.402	0.487
N	374	374	352	352	352	352	154	154	154	154

Note: The dependent variable is the cross-to-own-efficiency ratio. Size2 = 1 if insurer is in size quartile 2 (quartile 1 = smallest insurers), 0 otherwise; Size3 = 1 if insurer is in size quartile 3, 0 otherwise; Size4 = 1 if insurer is in size quartile 4, 0 otherwise; Stock = 1 if insurer is a stock insurer, 0 otherwise; Mutual = 1 if insurer is a mutual insurer, 0 otherwise; LT% = percentage of premiums in long tail-lines; BL% (Building-Lines) = percentage of premiums in the following three lines: fire, residential and commercial building damage, homeowner's personal property; 1995,…,2004 = year dummies for 1995,…, 2004. Statistical significance of difference in means is based on a t-test. ***, **, and * denotes statistical significance at the 1, 5, and 10 percent level, respectively. Numbers in parentheses are standard deviations.