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Estimating and Explaining the Financial Performance of Property and Casualty Insurers: A Two-Stage Analysis

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Abstract

The purpose of this study is to estimate and explain the performance of nonlife (i.e., property and casualty) insurers. The analysis consists of two stages. First, we propose the use of a multicriteria method to assess the condition of insurers while considering simultaneously a set of conflicting financial criteria. Then, we use regression analysis to examine the influence of firm-specific and country-specific attributes on the overall measure of performance obtained during the first stage. Macroeconomic conditions such as gross domestic product (GDP) growth, inflation, and income inequality are the most robust predictors of performance. However, other country-specific characteristics that relate to the institutional environment and financial or economic freedom do not appear to matter.

Keywords: Insurance companies, financial performance, multicriteria decision analysis

JEL Classification codes: G22, C44, C67

The insurance sector plays an important role in the financial services industry in almost all developed and developing countries, contributing to economic growth, efficient resource allocation, reduction of transaction costs, creation of liquidity, facilitation of economies of scale in investment, and spread of financial losses (Das, Davies, & Podpiera, 2003; Haiss & Sümegi, 2008). Consequently, the financial performance of insurance firms is of major importance to various stakeholders such as policyholders, agents, and policy makers. Within this context, one question that naturally emerges is how one can measure the financial performance of insurance firms. This leads to a second question that is which firm-specific and country-specific characteristics influence the financial performance of insurance firms.

The aim of this study is to answer the aforementioned questions. Our analysis consists of two steps. First, we use a multicriteria method to estimate a combined indicator of overall financial performance. As Von Stauffenberg, Jansson, Kenyon, and Barluenga-Badiola (2003) mentioned, all traditional financial indicators tend to be of limited value when examined in isolation. For example, to analyze how an insurer achieves its profits, one must also take into account other indicators that influence its well-being, such as operational efficiency, technical reserves provision, liquidity, and equity base.

However, looking at these dimensions on an individual basis may provide puzzling results. In particular, an insurer can increase its short-term profits by taking excessive risks, which, at the very least, should be covered by a higher equity base. Nonetheless, even a relatively high solvency margin might turn out to be inadequate if the technical provisions are too low. Within this context, multicriteria techniques can be particularly useful in evaluating whether firms are performing better or worse than their competitors. Their main advantage over traditional techniques is that they summarize performance in a single score that simultaneously assesses differences among firms in a multidimensional framework (Devinney, Yip, & Johnson, 2010; Eling & Luhnen, 2010b).

In the second stage of our analysis, we use regression analysis in an attempt to explain differences in the overall financial performance of firms across countries. The investigation of the determinants of performance has attracted the interest of researchers from the fields of international business, strategic management, and finance (e.g., McGahan & Victer, 2010; Short, Ketchen, Palmer, & Hult, 2007). However, insurance firms are considerably under-researched compared to nonfinancial firms and traditional banking institutions. Focusing on a large set of countries allows us to investigate a broad set of indicators including macroeconomics, institutional development, and insurance and financial development.

Thus, the two-stage analysis facilitates the investigation of the effect that external conditions have on the performance of insurers. In particular, the multicriteria evaluation stage considers only factors and performance measures that involved the internal operation of the firms. These are suitable for building a performance benchmarking model. On the other hand, through the second stage results, we focus on the analysis of the effect that external factors have on the performance of insurers, which is important from a policy-making perspective.

The rest of the paper is as follows. The next section provides a brief review of the literature. The section that follows contains a presentation of the data and methodology followed by a discussion of the empirical results in the results section. Finally, the conclusions can be found in the last section.

Literature Review

Existing studies related to the financial performance of insurance firms can be broadly classified in the following four categories: (a) studies that look at individual financial ratios, (b) studies that examine the credit ratings of firms, (c) failure prediction studies, and (d) studies on the efficiency of insurers.

The first group includes studies that consider individual ratios like return on equity (Born, 2001), the combined ratio (Fiegenbaum & Thomas, 1990), market share (Fiegenbaum & Thomas, 1990), and asset growth (Hardwick & Adams, 2002). The main disadvantage of these studies is that they offer only a partial assessment of performance, depending on the selected measure.

The second group includes studies that examine the creditworthiness of insurance firms using the ratings of specialized agencies. These studies deal with various topics such as the explanation of differences across agencies (Pottier & Sommer, 1999), the determinants of ratings (Adams, Burton, & Hardwick, 2003), and the ability to develop classification models to forecast the ratings (Florez-Lopez, 2007; Van Gestel et al., 2007). There are two main drawbacks associated with these studies. The first is that they are usually limited to large insurance firms with credit ratings. The second is that there are various criticisms against rating agencies such as fallibility, bad faith, timeliness, and bias towards or obliviousness to the market criticism (Golin, 2001).

The third strand of the literature constructs failure prediction models. In general, these studies use a sample of solvent and insolvent firms and a variety of quantitative techniques such as hazard models (Kim, Anderson, Amburgey, & Hickman, 1995), logit analysis (Chen & Wong, 2004; Cummins, Harrington, & Klein, 1995), genetic programming (Salcedo-Sanz, Fernández-Villacañas, Segovia-Vargas, & Bousoño-Calzón, 2005), and artificial neural networks (Hsiao & Whang, 2009). One of the main shortcomings of this group of studies is the necessity to have data on failed firms.

The last strand of the literature employs frontier techniques to estimate the efficiency of insurance firms in transforming inputs into outputs. In recent years, studies on the efficiency of insurance firms have examined topics linked to various issues such as consolidation (Cummins, Tennyson, & Weiss, 1999), conglomeration (Berger, Cummins, Weiss, & Zi, 2000), initial public offerings (Xie, 2010), corporate governance (Hardwick, Adams, & Hong, 2003), distribution systems (Brockett, Cooper, Golden, Rousseau, & Wang, 2005), competition (Bikker & Van Leuvensteijn, 2008), and the comparison of alternative frontier techniques (Cummins & Zi, 1998).

Most of these studies focused on single countries, while a few others provided cross-country evidence (Eling & Luhnen, 2010a; Rai, 1996). These studies have used a variety of techniques like data envelopment analysis, stochastic frontier analysis, distribution free approach, and thick frontier approach. Each one of these techniques has its advantages and disadvantages. However, in general one has to make a number of assumptions about measurement errors, inputs and outputs, the form of the frontier function, returns to scale, the heterogeneity of the firms in the sample, and technological differences in cross-country comparisons.[1]

Methodology and Data

Multicriteria Methodology

Multicriteria decision analysis (MCDA) is well-suited to problems involving the evaluation of a set of alternatives over multiple criteria. In this study, we employ the preference ranking organization method for enrichment evaluations (PROMETHEE) II method (Brans & Vincke, 1985), which is a popular multicriteria evaluation technique based on the theory of outranking relations (Roy, 1996). The method leads to the development of a relational preference model, which is based on the comparison of the insurance companies in a pairwise manner. In particular, the preference model (net flow) is expressed as follows:

$$\Phi(\mathbf{x}_i) = \frac{1}{m-1}\sum_{j=1}^{m}\left[\sum_{k=1}^{n} w_k\left(\pi_k(x_{ik}, x_{jk}) - \pi_k(x_{jk}, x_{ik})\right)\right] \tag{1}$$

where $\mathbf{x}_i = (x_{i1}, \ldots, x_{in})$ and $\mathbf{x}_j = (x_{j1}, \ldots, x_{jn})$ are the data for the insurance firms i and j over n evaluation criteria (all criteria are assumed to be in maximization form), and $\pi_k(x_{ik}, x_{jk})$ is the partial preference index indicating (in a $[0, 1]$ scale) the strength of the preference for firm i over firm j on criterion k.

In this study, the Gaussian function is used to define all partial preference indices:

$$\pi_k(x_{ik}, x_{jk}) = \begin{cases} 1 - \exp\left[-\frac{1}{2\gamma_k^2}(x_{ik} - x_{jk})^2\right] & \text{if } x_{ik} \geq x_{jk} \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

where $\gamma_k > 0$ is a user-defined constant. Except for the Gaussian function, Brans and Vincke (1985) proposed five more piecewise linear forms of preference functions suitable for quantitative and qualitative criteria. In the case of quantitative criteria such as those used in this study, the Gaussian function can be considered a generalization of all the other five forms. Furthermore, the fact that the Gaussian preference function is smooth contributes to the stability and the robustness of the obtained results (Brans, Vincke, & Mareschal, 1986).

The net flow (1) ranges in $[-1, 1]$. The case $\Phi(\mathbf{x}_i) \approx 1$ indicates that firm i is almost strictly preferred over all firms in the sample, whereas $\Phi(\mathbf{x}_i) \approx -1$ indicates that firm i is almost strictly outperformed by all other firms.

The parameters of the PROMETHEE II model include the weights of the criteria $w_1, w_2, \ldots, w_n$ as well as the preference parameters $\gamma_1, \gamma_2, \ldots, \gamma_n$. In a common decision-making setting, these parameters are either specified directly by the decision maker on the basis of his or her experience of the problem at hand or estimated through disaggregation techniques which enable the fitting of a decision model to a set of decision instances (Eppe, De Smet, & Stützle, 2011). However, these approaches are not applicable in the context of this study. Thus, a simulation approach is employed. Simulation techniques have become popular recently in the context of MCDA (see for instance Lahdelma, Hokkanen, & Salminen, 1998; Lahdelma & Salminen, 2001) providing a powerful way to perform comprehensive evaluations under different scenarios with respect to the relative importance of the criteria and the form of the evaluation model.

Following this approach, in the context of this study, 10000 scenarios are considered for the weights of the criteria. According to Tervonen and Lahdelma (2007), such a large number of scenarios is sufficient to obtain accurate results of the evaluation of the alternatives in a Monte Carlo simulation context. In each scenario, a random criteria weighting vector is generated from the uniform distribution over the unit simplex, thus enabling the consideration of all possible scenarios with respect to the relative importance of the criteria (including cases where all criteria have similar importance but also cases where one criterion dominates the evaluation process). The PROMETHEE II method is then used to perform the evaluation of the insurance firms under each weighting scenario.

In all cases, the preference parameters are set such that $\gamma_k = 0.5\sigma_k$ $(k = 1,\ldots,n)$, where σ_k is the standard semideviation of the pairwise differences $x_{ik} - x_{jk}$ (for all pairs of firms $\{\mathbf{x}_i, \mathbf{x}_j\}$) on criterion k. Using too high values for the parameters of the preference functions corresponds to situations where the decision maker has a strict preference for a firm *i* over another firm *j* only if x_{ik} is much larger than x_{jk}. On the other hand, using too low values for the values for the parameters of the preference functions corresponds to situations where the decision maker has a strict preference for a firm *i* over another firm *j* even if $x_{ik} \approx x_{jk}$. The aforementioned specification used in the context of this study was found to correspond to reasonably balanced evaluation, providing a good discrimination between the firms in the sample, both globally as well as on each individual evaluation criterion.

Variables

Financial performance criteria

To estimate the overall performance indicator, we rely on seven core financial ratios (i.e., criteria). Because there is no theoretical guidance for the selection of specific criteria, the set that we use is selected on the basis of: (a) data availability, (b) previous studies on insurance firms, and (c) an attempt to cover various dimensions of the financial profile of insurers.

The first ratio is the equity to assets, which is a general indicator of an insurer's capital strength (*EQAS*). We also include the solvency ratio (*SOLV*) which reveals the protection provided by shareholders for the volume of business written by the insurer. The higher the values of *EQAS* and *SOLV,* the higher the capital available to absorb any negative results.

Technical provisions constitute another part of the solvency framework in the insurance industry. The International Association of Insurance Supervisors (IAIS) highlighted the importance of technical provisions by stating that "these aspects of solvency assessment (namely technical provisions and capital) are intrinsically inter-related and cannot be considered in isolation in a solvency regime" (IAIS, 2007, p. 5). This is in line with the argument of Kannou (2007) who mentioned that when the technical reserve is not taken into consideration, the solvency margin may not be conclusively determined. As Kannou explained, a rather low solvency ratio may prove sufficient if the reserving policy is very prudent, whereas a relatively high solvency margin might turn out to be inadequate if the technical provisions are too low. Therefore, to account for the provisioning policy of the insurance firms, we include the technical reserves ratio (*TRESERV*), calculated as net technical reserves to net premium written.

Insurance firms must also ensure that they maintain sufficient amounts of liquid assets to cover their liabilities as they come due. Therefore, we include the ratio of liquid assets to total liabilities (*LIQUID*). From the perspective of liquidity risk, higher figures indicate a better ability to respond quickly to heavy cash calls. However, the liquid assets include items such as cash, shares, and assets held to cover linked liabilities, which traditionally generate lower returns than other investments. Thus, managers will have to consider simultaneously the assets, liabilities, and target profits of their firms, illustrating the importance the multidimensional overall indicator of performance.

We assess the efficiency in underwriting with two traditional financial ratios. The first is the operating expense ratio (*OPEXP*), calculated as underwriting expenses (including commissions) to net premiums written. Obviously, lower figures indicate higher efficiency in expenses management. The second indicator is the loss ratio (*LOSSR*) calculated as incurred losses and loss adjustment expenses to net premiums earned. High loss ratios may indicate a poor financial condition, as firms may not be collecting enough premiums to cover claims, pay expenses, and still earn an adequate return. For example, a loss ratio of 80% reveals that the insurance company pays out $80 in claims for every $100 in collected premiums. This could indicate a need for better risk management policies to guard against future possible insurance payouts.

Finally, we use the return on assets (*ROA*) calculated as profit before taxes to total assets. This ratio reveals how effectively the firm is converting the money it had to invest into profits. Thus, higher figures are preferable.

Determinants of performance

In our investigation of the factors that influence the overall performance of insurers, we consider various firm-specific characteristics and country-specific attributes. The natural logarithm of total assets (*SIZE*) is included to control for differences in size (e.g., Cummins et al., 1995; Cummins & Sommer, 1996). To account for nonlinear effects of size, we also include the squared term of the logarithm of total assets (*SIZEsq*). Finally, we examine the effect of reinsurance, using the risk retention ratio (*RETENT*). This ratio is calculated as net premium to gross premium, and it reveals the underwriting strategy. Transferring a large proportion of risk to a reinsurer can reduce the uncertainty regarding the frequency and magnitude of future losses, allowing the insurance firm to sustain an economic shock (Adams, 1996). However, in such cases, the insolvency of the reinsurer could adversely affect the financial strength of the primary insurance firm.[2]

The first group of country-level variables captures macroeconomic conditions. We include the real GDP growth (*GDPGR*) because problems in the financial sector are more likely to emerge when the growth is low (Demirgüç-Kunt & Detragiache, 1998). We use the inflation rate (*INFL*) as a proxy for monetary instability. Past studies indicate that countries with high inflation have underdeveloped financial systems and experience financial crises (Boyd, Levine, & Smith, 2001; Demirgüç-Kunt & Detragiache, 1998). Furthermore, we consider the Gini index which is a measure of inequality of income (*GINI*). Finally, we use the natural logarithm of the gross national income per capita in U.S. dollars (*GNICAP*).

The second set of country-level variables reveals the development in the insurance, banking, and financial services industry. We use the following four variables: (a) nonlife insurance premium to GDP (*PREM*), (b) bank domestic credit to GDP (*CREDIT*), (c) stock market capitalization to GDP (*MCAP*), and (d) insurance and financial services as a percentage of service imports (*FINSERV*).

IAIS core principles highlight the need for "a reliable, effective, efficient and fair legal and court system… whose decisions are enforceable" (IAIS, 2003, p. 7). For example, in countries with low legal protection, corruption, and overall poor quality of legal institutions, there may be higher opportunities for gambling and risk-taking. To capture the quality of the institutions in a country, we use information from the World Bank Governance Indicators database (WGI), and we calculate an overall institutional development index (*INSTDEV*) by taking the average of: (a) voice and accountability, (b) political stability and absence of violence, (c) government effectiveness, (d) regulatory quality, (e) rule of law, and (f) control of corruption.[3] We also estimate an enforcement index (*ENFIND*) on the basis of a subset of these criteria that includes the rule of law, regulatory quality, and control of corruption (see Li, Moshirian, Pham, & Zein, 2006).

To capture the regulatory conditions in the financial industry, we use the financial freedom index (*FINFR*) of the Heritage Foundation. This index reveals the extent of government regulation of financial services (banking, insurers, capital markets), the difficulty of opening and operating financial services firms (for both domestic and foreign individuals), and government influence on the allocation of credit. Finally, we consider the overall freedom in a country by considering the Heritage economic freedom index (*ECONFR*) that is estimated on the basis of the following ten indicators: business freedom, trade freedom, fiscal freedom, government spending, monetary freedom, investment freedom, financial freedom, property rights, freedom from corruption, labor freedom. Both *FINFR* and *ECONFR* can take values between 0 and 100 with higher figures corresponding to higher freedom.

Data

Our data source for firm-specific data is the A. M. Best's *Insurance Reports–Non-US* (A. M. Best, 2010) that contains information on insurance firms from a number of countries over the period 2005-2009. We restrict our dataset in numerous ways. First, when both consolidated and unconsolidated statements are available, we use the latter to avoid double-counting. Second, we exclude reinsurance firms, captive firms, branches of insurance firms, and holding companies. Third, we focus on property and casualty insurance firms to avoid differences with life and composite insurers. Finally, we exclude firms for which we do not have data for all the seven indicators described in the financial performance criteria subsection.

Our final sample consists of 2176 property and casualty insurance firms operating in 91 countries, an unbalanced panel of 9181 observations from the period 2005-2009. Country-level data are obtained from the following sources: Heritage Foundation, the Global Market Information database (GMID), the WGI, the World Bank Development Indicators database (WDI), and the World Bank Financial Development and Structure

database (FDS). Table 1 presents descriptive statistics, while Table 2 presents the correlation coefficients. The appendix provides a summary of the variables and the databases.

Table 1
Descriptive Statistics

	Average	Median	*SD*
Panel A: Variables used in the estimation of the PROMETHEE score			
EQAS	38.931	34.176	22.915
SOLV	352.542	95.285	704.186
TRESERV	161.984	104.000	200.115
LIQUID	122.850	90.601	112.224
OPEXP	34.888	28.200	44.314
LOSSR	60.960	64.200	42.976
ROA	4.107	3.756	7.841
Panel B: Variables used in second stage regressions			
SIZE	11.587	11.523	2.033
RETENT	72.348	81.404	26.953
GDPGR	2.290	2.700	3.618
INFL	3.239	2.300	3.084
GINI	36.297	34.200	7.034
GNICAP	10.175	10.585	0.997
PREM	3.068	3.140	1.366
CREDIT	139.618	134.298	59.515
MCAP	86.943	69.688	64.418
FINSERV	6.748	4.487	7.063
FINFR	68.743	70.000	18.890
ENFIND	1.210	1.629	0.827
INSTDEV	1.072	1.420	0.747
ECONFR	70.286	70.600	8.704

Note. Variables are defined in the appendix.

Table 2
Correlation Coefficients of Variables Used in Second Stage Regressions

	SIZE	*RETENT*	*GDPGR*	*INFL*	*GINI*	*GNICAP*	*PREM*	*CREDIT*	*MCAP*	*FINSERV*	*FINFR*	*ENFIND*	*INSTDEV*
RETENT	0.124												
GDPGR	-0.119	-0.079											
INFL	-0.198	-0.142	0.372										
GINI	-0.112	-0.184	0.246	0.304									
GNICAP	0.207	0.188	-0.390	-0.660	-0.545								
PREM	0.115	0.112	-0.144	-0.443	-0.312	0.647							
CREDIT	0.130	0.152	-0.415	-0.500	-0.272	0.622	0.564						
MCAP	0.099	0.082	0.150	-0.240	-0.003*	0.239	0.320	0.288					
FINSERV	-0.105	-0.120	0.012*	0.064	0.304	-0.088	-0.082	-0.066	-0.033				
FINFR	-0.005*	0.092	-0.307	-0.385	-0.254	0.581	0.523	0.565	0.228	0.127			
ENFIND	0.188	0.161	-0.370	-0.650	-0.523	0.897	0.655	0.665	0.278	-0.159	0.663		
INSTDEV	0.187	0.167	-0.371	-0.661	-0.530	0.912	0.649	0.644	0.264	-0.163	0.643	0.991	
ECONFR	0.095	0.067	-0.308	-0.492	-0.224	0.708	0.609	0.659	0.338	0.100	0.643	0.832	0.806

Note. (a) Variables are defined in the appendix. (b) All correlations are significant at the 1% level except those marked with *.

Empirical Results

Multicriteria Evaluation

Table 3 presents the PROMETHEE scores averaged over all 10000 simulation runs, grouped by the firms' status, the country-level development status, and time. We observe that: (a) unaffiliated firms appear to perform better than affiliated firms; (b) firms operating in advanced countries are the best performers, whereas those operating in transitional countries are the worst performers;[4] and (c) the overall performance of insurers deteriorated during the years of the crisis (i.e., 2008-2009).

Table 3
Univariate Comparisons of Overall Financial Performance (PROMETHEE Scores)

	Observations	Mean	Min.	Max.	*SD*
Insurer's group status					
Affiliated firms	4 807	-0.021	-0.551	0.746	0.187
Unaffiliated firms	4 374	0.023	-0.526	0.670	0.203
Country development status					
Major advanced countries	2 955	-0.025	-0.518	0.742	0.192
Advanced countries	3 959	0.031	-0.551	0.746	0.203
Transition countries	424	-0.044	-0.444	0.646	0.178
Developing countries	1 749	-0.018	-0.504	0.698	0.182
Year					
2005	1 789	0.011	-0.497	0.681	0.196
2006	1 971	0.015	-0.469	0.742	0.195
2007	2 037	0.008	-0.551	0.746	0.196
2008	2 045	-0.025	-0.466	0.664	0.196
2009	1 339	-0.011	-0.509	0.703	0.196

Note. The classification by country development status does not include 94 observations from Gibraltar, Guernsey, Isle of Man, Liechtenstein, and Macau because of lack of information as to the classification.

Table 4 presents further results on the relationship (correlations) between the average scores of the firms (over all simulation scenarios) and the seven ratios that serve as evaluation criteria. As expected, most ratios have a strong monotone relationship with the overall evaluation scores. *TRESERV* (net technical reserves/net premium written) and *OPEXP* (underwriting expenses/net premiums written) show some nonlinearities, and generally these two ratios seem to have a weaker association with the multicriteria evaluation results.

Table 4
Correlations between the Multicriteria Scores and the Financial Ratios

Ratios	Correlation coefficient
EQAS	0.738
SOLV	0.474
TRESERV	0.129
LIQUID	0.651
OPEXP	-0.002
LOSSR	-0.410
ROA	0.562

Finally, Tables 5 and 6 present results with regard to the priorities given in the selected financial ratios and their effect on the evaluation of the firms. In particular, for each ratio, *k*, we calculate the difference in the mean scores of the firms under the scenarios where ratio *k* is assigned top priority (i.e., the highest weight among all ratios) in comparison to the scores under the scenarios where the ratio is assigned the lowest priority. Table 5 summarizes the results by the insurer's group status, whereas Table 6 involves the country development groups. The results of Table 5 indicate that the scores of unaffiliated firms improve under the scenarios where *EQAS* and *LIQUID* are considered as the most important ratios. In both cases, the improvements over the scenarios in which these two ratios are given low priority is statistically significant at the 1% level.

On the contrary, affiliated firms perform worse when *EQAS* and *LIQUID* are given top priority. With regard to the country development groups, firms from major advanced economies perform better in scenarios where *SOLV*, *TRESERV*, and *OPEXP* receive top priority. On the other hand, their performance deteriorates in scenarios where *EQAS*, *LIQUID*, and *ROA* receive top priority. Firms from developing countries exhibit almost the exact opposite performance patterns. In this case, however, the priority given to *SOLV* does not seem to have a significant effect on the evaluation of the firms, whereas *LOSSR* priority has a strong positive effect. Furthermore, it is worth noting firms from developing and transition economies exhibit higher differences in their evaluation scores under different scenarios for the priorities of the financial ratios, whereas firms from more advanced economies exhibit a more robust performance.

Table 5
Effect of Weighting Priorities on the Evaluation Scores Averaged by the Insurer's Group Status

	Unaffiliated firms	Affiliated firms
EQAS	0.033**	-0.030**
SOLV	-0.004**	0.004*
TRESERV	-0.021**	0.019**
LIQUID	0.022**	-0.020**
OPEXP	-0.007**	0.006*
LOSSR	-0.014**	0.013**
ROA	-0.008**	0.007**

Note. * Statistically significant at the 5% level. ** Statistically significant at the 1% level.

Table 6
Effect of Weighting Priorities on the Evaluation Scores Averaged by Country Development Status

	Major advanced	Advanced	Transition	Developing
EQAS	-0.032**	0.001	0.010	0.052**
SOLV	0.010**	-0.005**	-0.008	-0.003
TRESERV	0.032**	0.005	-0.038**	-0.055**
LIQUID	-0.010**	0.014**	-0.037**	-0.004
OPEXP	0.014**	0.009**	0.002	-0.045**
LOSSR	0.002	-0.030**	0.061**	0.047**
ROA	-0.015**	0.006*	0.012	0.010*

Note. * Statistically significant at the 5% level. ** Statistically significant at the 1% level.

Determinants of Overall Performance

Table 7 presents our base model in which the PROMETHEE II scores are regressed against the set of firm-specific variables and the macroeconomic indicators. Considering the correlations between some of the country-level attributes and the loss of different observations for different countries, the variables that capture the market and institutional development are added sequentially in the specifications shown in Tables 8 and 9. Because we have a panel dataset, we estimate our specifications using a fixed effects model.[5] Furthermore, to correct for heteroskedasticity, we obtain robust standard errors clustered at the firm-level.

In columns (1) to (4) of Table 7, we include one by one the macroeconomic indicators. The last column includes simultaneously all the indicators, with the exception of *GNICAP* that is excluded due to a high correlation with *INFL* (-0.660) and *GINI* (-0.545). *SIZE* carries a negative and statistically significant coefficient that is robust across all our regressions. Thus, smaller insurance firms appear to be in a better position, and there is no evidence of nonlinear effects as shown by the insignificance of *SIZEsq*. *RETENT* is also insignificant, indicating that the underwriting strategy with regard to reinsurance does not exercise an influence on overall performance. Turning to the macroeconomic indicators, we observe that *GDPGR*, *INFL*, and *GINI* enter with a statistically significant effect, whereas *GNICAP* is insignificant. Thus, consistent with our expectations, higher GDP growth, lower inflation, and lower income inequality promote the overall performance of insurers.

Table 7
Overall Financial Performance and Macroeconomics

	(1)	(2)	(3)	(4)	(5)
SIZE	-0.075**	-0.074**	-0.070**	-0.077**	-0.057*
	(0.028)	(0.032)	(0.043)	(0.025)	(0.094)
SIZEsq	0.002	0.002	0.001	0.002	0.001
	(0.233)	(0.299)	(0.356)	(0.241)	(0.418)
RETENT	0.000	0.000	0.000	0.000	0.000
	(0.139)	(0.164)	(0.201)	(0.185)	(0.150)
GDPGR	0.002***				0.003***
	(0.000)				(0.000)
INFL		-0.005***			-0.005***
		(0.000)			(0.000)
GINI			-0.005***		-0.007***
			(0.006)		(0.000)
GNICAP				-0.027	
				(0.373)	
Constant	0.604***	0.636***	0.796***	0.909***	0.758***
	(0.003)	(0.001)	(0.000)	(0.009)	(0.000)
F-test	18.49***	20.02***	14.02***	11.16***	21.99***
Number of countries	87	87	67	83	67
Number of firms	2 167	2 167	2 089	2 132	2 089
Number of observations	9 119	9 119	8 890	9 041	8 890
Hausman test	31.93***	12.40**	16.67***	21.45***	19.54***

Note. (a) * Statistically significant at the 10% level. ** Statistically significant at the 5% level. *** Statistically significant at the 1% level. (b) Variables are defined in the appendix. (c) Dependent variable is the overall performance score obtained from the application of the PROMEETHE II method. (d) Fixed effects regressions with robust errors clustered at the firm level.

The results in Table 8 show that *PREM* and *FINSERV* have an insignificant effect on the performance of insurers. However, the stock market development (*MCAP*) has a positive effect on insurers' performance. In contrast, the more developed the banking sector (*CREDIT*), the lower the overall performance of insurance firms, a finding that could be explained by competition and substitution in the financial services offered by insurers and banking firms. Nonetheless, the effect of *CREDIT* disappears once we simultaneously control for the remaining country-specific attributes in column 5.

Table 8
Overall Financial Performance, Macroeconomics, Financial and Insurance Development

	(1)	(2)	(3)	(4)	(5)
SIZE	-0.067* (0.059)	-0.055 (0.111)	-0.065* (0.061)	-0.067* (0.054)	-0.079** (0.034)
SIZEsq	0.002 (0.250)	0.001 (0.415)	0.001 (0.345)	0.002 (0.288)	0.002 (0.156)
RETENT	0.000* (0.081)	0.000 (0.148)	0.000 (0.155)	0.000 (0.144)	0.000 (0.113)
GDPGR	0.002*** (0.001)	0.002*** (0.000)	0.002*** (0.007)	0.002*** (0.000)	0.002*** (0.007)
INFL	-0.006*** (0.000)	-0.005*** (0.000)	-0.004*** (0.000)	-0.006*** (0.000)	-0.004*** (0.000)
GINI	-0.005** (0.015)	-0.009*** (0.000)	-0.007*** (0.000)	-0.007** (0.000)	-0.005** (0.013)
PREM	0.264 (0.329)				-0.089 (0.744)
CREDIT		-0.000** (0.049)			-0.000 (0.217)
MCAP			0.000*** (0.000)		0.000** (0.011)
FINSERV				0.002 (0.187)	0.002 (0.126)
Constant	0.690*** (0.002)	0.817*** (0.000)	0.777*** (0.000)	0.790*** (0.002)	0.764*** (0.001)
F-test	15.31***	20.50***	22.18***	17.30***	10.91***
Number of countries	62	65	64	61	58
Number of firms	2 043	2 076	2 076	1 975	1 945
Number of observations	8 115	8 751	8 817	8 302	7 528
Hausman test	14.18**	45.05***	45.04***	15.63**	24.45***

Note. (a) * Statistically significant at the 10% level. ** Statistically significant at the 5% level. *** Statistically significant at the 1% level. (b) Variables are defined in the appendix. (c) Dependent variable is the overall performance score obtained from the application of the PROMETHEE method. (d) Fixed effects regressions with robust errors clustered at the firm level.

In Table 9, we include in the regressions the variables that capture aspects of the regulatory environment and the institutional development. Due to high correlations, these variables enter the analysis one by one, only. It appears that none of these country-specific characteristics influences the overall performance of nonlife insurers.

Table 9
Overall Financial Performance, Macroeconomics, Regulatory and Institutional Development

	(1)	(2)	(3)	(4)
SIZE	-0.058* (0.088)	-0.057* (0.093)	-0.058* (0.088)	-0.057* (0.093)
SIZEsq	0.001 (0.401)	0.001 (0.404)	0.001 (0.400)	0.001 (0.413)
RETENT	0.000 (0.151)	0.000 (0.140)	0.000 (0.141)	0.000 (0.152)
GDPGR	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)
INFL	-0.006*** (0.000)	-0.006*** (0.000)	-0.006*** (0.000)	-0.006*** (0.000)
GINI	-0.008*** (0.000)	-0.007*** (0.001)	-0.007*** (0.000)	-0.007*** (0.000)
FINFR	-0.000 (0.349)			
ENFIND		-0.039 (0.124)		
INSTDEV			-0.037 (0.127)	
ECONFR				-0.000 (0.745)
Constant	0.775*** (0.000)	0.778*** (0.000)	0.789*** (0.000)	0.776*** (0.000)
F-test	19.38***	19.33***	19.26***	18.97***
Number of countries	67	66	66	67
Number of firms	2 089	2 088	2 088	2 089
Number of observations	8 890	8 885	8 885	8 890
Hausman test	53.22***	75.16***	65.92***	54.51***

Note. (a) * Statistically significant at the 10% level. ** Statistically significant at the 5% level. *** Statistically significant at the 1% level. (b) Variables are defined in the appendix. (c) Dependent variable is the overall performance score obtained from the application of the PROMETHEE method. (d) Fixed effects regressions with robust errors clustered at the firm level.

Conclusions

The well-being of insurance firms is of importance to various stakeholders such as policyholders, policy makers, investors, and managers. However, the individual financial ratios that are commonly used to assess the financial condition of insurers offer only a partial view of their performance. Therefore, in the present study, we propose the application of a multicriteria methodology that provides an overall measure of performance while considering simultaneously a number of conflicting criteria. Then, we attempt to explain differences in the performance of insurers on the basis of various country-specific attributes.

Using a sample of over 2000 nonlife insurance firms operating in 91 countries between 2005 and 2009, we find that macroeconomic indicators such as real GDP growth, inflation, and income inequality influence the overall performance of firms. Stock market development also has a positive effect on performance. In contrast, other indicators of the banking and capital market development such as the insurance premium to GDP, bank credit to GDP, and insurance and financial services as percentage of import services are not significant. Similarly, the institutional development and the overall freedom in the financial services industry do not exercise a statistically significant effect on overall performance.

Future analysis could extend our work in various directions. First, one could include firm-level attributes relating to corporate governance. Such data were not available in our case, but we hope that future research will improve upon that. Second, one could compare the nonlife insurers with life insurers or combined insurers. Third, one could compare insurance firms with banks.

Endnotes

[1] See Coelli, Prasada Rao, O'Donnell, and Battese (2005) for a general discussion on efficiency and productivity analysis with the use of frontier techniques and Eling and Luhnen (2010b) for a review of applications in the insurance industry.

[2] In unreported regressions which also controlled for the effect of group structure by including a dummy variable that takes the value of 1 if the firm is an unaffiliated single company and 0 otherwise (*SINGLE*). Cummins and Sommer (1996) reported that insurance groups are viewed by the market as being more risky than unaffiliated single firms. *SINGLE* was insignificant in these regressions and was eventually dropped from further analysis as we used fixed effects that do not allow the inclusion of time invariant characteristics.

[3] The score for each one of these factors ranges between -2.5 and 2.5 with higher scores corresponding to better outcomes.

[4] When we grouped firms by country development status, we excluded 94 observations from Gibraltar, Guernsey, Isle of Man, Liechtenstein, and Macau because of lack of information as to their classification.

[5] The fixed effects specification was supported by the Hausman test (see Tables 7, 8, and 9).

References

Adams, M. (1996). The reinsurance decision in life insurance firms: An empirical test of the risk-bearing hypothesis. *Accounting & Finance*, *36*(1), 15-30. doi:10.1111/j.1467-629X.1996.tb00296.x

Adams, M., Burton, B., & Hardwick, P. (2003). The determinants of credit ratings in the United Kingdom insurance industry. *Journal of Business Finance & Accounting*, *30*(3-4), 539-572. doi:10.1111/1468-5957.00007

A. M. Best. (2010, March). *A. M. Best's insurance reports-non-US*. Tewksbury, NJ: A. M. Best.

Berger, A. N., Cummins, J. D., Weiss, M. A., & Zi, H. (2000). Conglomeration versus strategic focus: Evidence from the insurance industry. *Journal of Financial Intermediation*, *9*(4), 323-362. doi:10.1006/jfin.2000.0295

Bikker, J. A., & Van Leuvensteijn, M. (2008). Competition and efficiency in the Dutch life insurance industry. *Applied Economics*, *40*(16), 2063-2084. doi:10.1080/00036840600949298

Born, P. H. (2001). Insurer profitability in different regulatory and legal environments. *Journal of Regulatory Economics*, *19*(3), 211-237. doi:10.1023/A:1011161805740

Boyd, J., Levine, R., & Smith, B. (2001). The impact of inflation on financial sector performance. *Journal of Monetary Economics*, *47*(2), 221-248. doi:10.1016/S0304-3932(01)00049-6

Brans, J. P., & Vincke, P. (1985). A preference ranking organisation method. *Management Science, 31*(6), 647-656. doi:10.1287/mnsc.31.6.647

Brans, J. P., Vincke, P., & Mareschal, B. (1986). How to select and how to rank projects: The PROMETHEE method. *European Journal of Operational Research*, *24*(2), 228-238. doi:10.1016/0377-2217(86)90044-5

Brockett, P. L., Cooper, W. W., Golden, L. L., Rousseau, J. J., & Wang, Y. (2005). Financial intermediary versus production approach to efficiency of marketing distribution systems and organizational structure of insurance companies. *Journal of Risk and Insurance*, *72*(3), 393-412. doi:10.1111/j.1539-6975.2005.00130.x

Chen, R., & Wong, K. A. (2004). The determinants of financial health of Asian insurance companies. *Journal of Risk and Insurance*, *71*(3), 469-499. doi:10.1111/j.0022-4367.2004.00099.x

Coelli, T. J., Prasada Rao, D. S., O'Donnell, C. J., & Battese, G. E. (2005). *An introduction to efficiency and productivity analysis* (2nd ed.). New York, NY: Springer.

Cummins, J. D., Harrington, S. E., & Klein, R. (1995). Insolvency experience, risk-based capital, and prompt corrective action in property-liability insurance. *Journal of Banking & Finance*, *19*(3-4), 511-527. doi:10.1016/0378-4266(94)00136-Q

Cummins, J. D., & Sommer, D. W. (1996). Capital and risk in property-liability insurance markets. *Journal of Banking & Finance*, *20*(6), 1069-1092. doi:10.1016/0378-4266(95)00044-5

Cummins, J. D., Tennyson, S., & Weiss, M. A. (1999). Consolidation and efficiency in the US life insurance industry. *Journal of Banking & Finance*, *23*(2-4), 325-357. doi:10.1016/S0378-4266(98)00089-2

Cummins, J. D., & Zi, H. (1998). Comparison of frontier efficiency methods: An application to the U.S. life insurance industry. *Journal of Productivity Analysis*, *10*(2), 131-152. doi:10.1023/A:1026402922367

Das, U., Davies, N., & Podpiera, R. (2003). *Insurance and issues in financial soundness* (IMF Working Paper No. 03/138). Washington, DC: The World Bank.

Demirgüç-Kunt, A., & Detragiache, E. (1998). The determinants of banking crises in developing and developed countries. *IMF Staff Papers*, *45*(1), 81-109. doi:10.2307/3867330

Devinney, T. M., Yip, G. S., & Johnson, G. (2010). Using frontier analysis to evaluate company performance. *British Journal of Management*, *21*(4), 921-938. doi:10.1111/j.1467-8551.2009.00650.x

Eling, M., & Luhnen, M. (2010a). Efficiency in the international insurance industry: A cross-country comparison. *Journal of Banking & Finance*, *34*(7), 1497-1509. doi:10.1016/j.jbankfin.2009.08.026

Eling, M., & Luhnen, M. (2010b). Frontier efficiency methodologies to measure performance in the insurance industry: Overview, systematization, and recent developments. *The Geneva Papers on Risk and Insurance Issues and Practice*, *35*(2), 217-265. doi:10.1057/gpp.2010.1

Eppe, S., De Smet, Y., & Stützle, T. (2011). A bi-objective optimization model to eliciting decision maker's preferences for the PROMETHEE II method. In F. Rossi & A. Tsoukias (Eds.), *Proceedings of the 2nd International Conference on Algorithmic Decision Theory* (pp. 56-66). Berlin, Germany: Springer-Verlag. doi:10.1007/978-3-642-24873-3_5

Fiegenbaum, A., & Thomas, H. (1990). Strategic groups and performance: The U.S. insurance industry, 1970-84. *Strategic Management Journal, 11*(3), 197-215. doi:10.1002/smj.4250110303

Florez-Lopez, R. (2007). Modelling of insurers' rating determinants: An application of machine learning techniques and statistical models. *European Journal of Operational Research*, *183*(3), 1488-1512. doi:10.1016/j.ejor.2006.09.103

Golin, J. (2001). *The bank credit analysis handbook*: *A guide for analysts, bankers and investors.* Clementi, Singapore: John Wiley & Sons.

Haiss, P., & Sümegi, K. (2008). The relationship between insurance and economic growth in Europe: A theoretical and empirical analysis. *Empirica*, *35*(4), 405-431. doi:10.1007/s10663-008-9075-2

Hardwick, P., & Adams, M. (2002). Firm size and growth in the United Kingdom life insurance industry. *Journal of Risk and Insurance*, *69*(4), 577-593. doi:10.1111/1539-6975.00038

Hardwick, P., Adams, M., & Hong, Z. (2003). *Corporate governance and cost efficiency in the United Kingdom life insurance industry* (Working Paper No. 2003/1). Swansea, UK: European Business Management School.

Hsiao, S-H., & Whang, T-J. (2009). A study of financial insolvency prediction model for life insurers. *Expert Systems with Applications*, *36*(3), 6100-6107. doi:10.1016/j.eswa.2008.07.024

International Association of Insurance Supervisors. (2003). *Insurance core principles and methodology.* Retrieved from http://www.iaisweb.org/__temp/Insurance_core_principles_and_methodology.pdf

International Association of Insurance Supervisors. (2007). *Guidance paper on the structure of regulatory capital requirements*. Retrieved from http://www.iaisweb.org/__temp/2_1_1_Guidance_paper_on_the_structure_of_regulatory_capital_requirements.pdf

Kannou, M. (2007, June). Solvency and solvency margin. *The African Reinsurer*. Retrieved from http://www.africa-re.com/mgt1.pdf

Kim, Y-D., Anderson, D. R., Amburgey, T. L., & Hickman, J. C. (1995). The use of event history analysis to examine insurer insolvencies. *Journal of Risk and Insurance*, *62*(1), 94-110. doi:10.2307/253694

Lahdelma, R., Hokkanen, J., & Salminen, P. (1998). SMAA: Stochastic multiobjective acceptability analysis. *European Journal of Operational Research, 106*(1), 137-143. doi:10.1016/S0377-2217(97)00163-X

Lahdelma, R., & Salminen, P. (2001). SMAA-2: Stochastic multicriteria acceptability analysis for group decision making. *Operations Research, 49*(3), 444-454. doi:10.1287/opre.49.3.444.11220

Li, D., Moshirian, F., Pham, P. K., & Zein, J. (2006). When financial institutions are large shareholders: The role of macro corporate governance environments. *Journal of Finance*, *61*(6), 2975-3007. doi:10.1111/j.1540-6261.2006.01009.x

McGahan, A. M., & Victer, R. (2010). How much does home country matter to corporate profitability? *Journal of International Business Studies, 41*(1), 142-165. doi:10.1057/jibs.2009.69

Pottier, S. W., & Sommer, D. W. (1999). Property-liability insurer financial strength ratings: Differences across rating agencies. *The Journal of Risk and Insurance*, *66*(4), 621-642. doi:10.2307/253867

Rai, A. (1996). Cost efficiency of international insurance firms. *Journal of Financial Services Research, 10*(3), 213-233. doi:10.1007/bf00114085

Roy, B. (1996). *Multicriteria methodology for decision aiding.* Dordrecht, The Netherlands: Kluwer Academic Publishers.

Salcedo-Sanz, S., Fernández-Villacañas, J-L., Segovia-Vargas, M. J., & Bousoño-Calzón, C. (2005). Genetic programming for the prediction of insolvency in non-life insurance companies. *Computers and Operations Research, 32*(4), 749-765. doi:10.1016/j.cor.2003.08.015

Short, J. C., Ketchen, D. J., Palmer, T. B., & Hult, G. T. M. (2007). Firm, strategic group and industry influences on performance. *Strategic Management Journal*, *28*(2), 147-167. doi:10.1002/smj.574

Tervonen, T., & Lahdelma, R. (2007). Implementing stochastic multicriteria acceptability analysis. *European Journal of Operational Research, 178*(2), 500-513. doi:10.1016/j.ejor.2005.12.037

Van Gestel, T., Martens, D., Baesens, B., Feremans, D., Huysmans, J., & Vanthienen, J. (2007). Forecasting and analyzing insurance companies' ratings. *International Journal of Forecasting*, *23*(3), 513-529. doi:10.1016/j.ijforecast.2007.05.001

Von Stauffenberg, D., Jansson, T., Kenyon, N., & Barluenga-Badiola, M-C. (2003). *Performance indicators for microfinance institutions*: *Technical guide* (3rd ed.). Washington, DC: Inter-American Development Bank.

Xie, X. (2010). Are publicly held firms less efficient? Evidence from the US property-liability insurance industry. *Journal of Banking & Finance*, *34*(7), 1549-1563. doi:10.1016/j.jbankfin.2010.01.007

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Appendix

Definition of Variables and Data Sources

Acronym	Definition	Type*	Database
EQAS	Equity/total assets	Max	A.M. Best
SOLV	Equity/net premium written	Max	A.M. Best
TRESERV	Net technical reserves/net premium written	Max	A.M. Best
LIQUID	Liquid assets/total liabilities	Max	A.M. Best
OPEXP	Underwriting expenses (including commissions)/net premiums written	Min	A.M. Best
LOSSR	Incurred losses & loss adjustment expenses/net premiums earned	Min	A.M. Best
ROA	Profit before taxes/total assets	Max	A.M. Best
SIZE	Natural logarithm of total assets	Max	A.M. Best
SIZEsq	Natural logarithm of total assets squared	Max	A.M. Best
RETENT	Net premium/gross premium	Max	A.M. Best
GDPGR	Real GDP growth	Max	GMID
INFL	Inflation	Min	GMID
GNICAP	Natural logarithm of gross national income per capita ($)	Max	GMID
GINI	A measure of income inequality, based on a Lorenz curve. A society that scores 0 on the Gini index has perfect equality, where every inhabitant has the same income. The higher the number over 0, the higher the inequality, and a score of 100 indicates total inequality, where only one person receives all the income.	Min	GMID
PREM	Nonlife insurance premium (% GDP)	Min	FDS
CREDIT	Domestic credit provided by the banking sector (% GDP)	Max	WDI
MCAP	Market capitalization of listed companies (% GDP)	Max	WDI
FINSERV	Insurance and financial services (% service imports)	Max	WDI
FINFR	Indicates the extent of government regulation of financial services (banking, insurers, capital markets), the extent of state intervention, the difficulty of opening and operating financial services firms (for both domestic and foreign individuals), and government influence on the allocation of credit. It takes values between 0 and 100, with higher values indicating lower government intervention.	Max	Heritage Foundation
ENFIND	Average of three indicators measuring regulatory quality, rule of law, and control of corruption. The score for each one of these factors ranges between -2.5 and 2.5 with higher scores corresponding to better outcomes.	Max	WGI
INSTDEV	Average of six indicators measuring voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption. The score for each one of these factors ranges between -2.5 and 2.5 with higher scores corresponding to better outcomes.	Max	WGI
ECONFR	Indicates the degree of freedom over the following ten indicators: business freedom, trade freedom, fiscal freedom, government spending, monetary freedom, investment freedom, financial freedom, property rights, freedom from corruption, labor freedom. ECONFR can take values between 0 and 100 with higher figures corresponding to higher freedom.	Max	Heritage Foundation

Note. * The type of the criteria indicates whether higher values indicate better performance (Max) or the opposite (Min).