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THE WORLD'S LARGEST REINSURANCE GROUPS:
A LOOK AT NAMES, NUMBERS, COUNTRIES AND PERFORMANCE

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The world's largest reinsurance groups: a look at names, numbers, countries and performance

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Abstract

Many reinsurance companies have, in the past decade, increased their foreign direct investment and acquired other companies in part because of the belief that only very large players will have the cost advantages necessary to remain competitive in global markets. Since the strategic decision to expand activities in several foreign markets is implemented at the group level, the focus of this paper is to examine data available on the internationalization process of the world's largest reinsurance consolidated groups.

By examining the distribution of the total net premiums written by the largest reinsurance groups in the world, this paper documents several dimensions of the change in market concentration: the trend in concentration in the world's largest groups, and the relative position of these groups by countries. It also examines the geographic distribution of the world's largest reinsurance groups and the factors explaining their preferred locations of activities. Finally, the paper examines the relationship between geographical diversification and the performance for the world's largest reinsurance groups. It is verified that the form and nature of the relationship between international diversification and performance follow an S-shaped curve with increased diversification of the largest reinsurance groups.

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Key Words
Reinsurance, Performance, Degree of Internationalization

The world's largest reinsurance groups: a look at names, numbers, countries and performance

1. Introduction: an historical perspective

In 1980, eight of the twenty largest reinsurance companies in the world were German reinsurers, five were American reinsurers and others were originating from only six countries (Switzerland, United-Kingdom, France, Italy, Netherlands and Japan). In 2010, according to the latest publication of Standard & Poor's (S&P)[1] only two are German, five are American but four are headquartered in Bermuda and three in Japan. Among the twenty largest companies others are originating from 6 countries (Switzerland, France, Japan, Spain, Australia, The Republic of Korea and India). In fact the rising importance of Bermuda as a reinsurance center had already begun at the end of the 90's and in 2000 three groups were already in the top 20 (see table 1).[2]

London was traditionally the most important reinsurance center because of its unique organization "Lloyds". Germany and Switzerland developed their own reinsurance markets, and they still play an important role in the world's market. For many years the United States depended on foreign reinsurance. With the growth of the US reinsurance companies and the development of markets similar to that of Lloyds, the reinsurance capacity and the importance of the United States mainly increased after the 60's. Fifteen years ago, a United Nations study[3] revealed that the United States was the single most important home country for all services industries including financial services. More recently, the rapid expansion of Bermuda as a reinsurance center and the growth of Japanese reinsurance companies have changed the leadership in some reinsurance activities at the expense of reinsurers from the United States and some European countries.

In response to foreign market opportunities made available by deregulation and globalization, many financial firms have increased their foreign direct investment (FDI) and acquired other companies to become more international. Market-seeking motivations and strategies dominate transnational companies activities in financial services, but integrated international production networks are also emerging as efficiency-seeking firms take advantage of the growing

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[1] Standard & Poor's, Global Reinsurance Highlights, ReActions Publishing Group, London, 2011.
[2] Lloyd's of London, ranking 5th in 2010, is excluded from the list to ease comparison with earlier years.
[3] United Nations Centre on Transnational Corporations (UNCTC) (1989).

tradability of services.[4] The insurance industry has followed the general trend towards global markets and risks (BIS, 2001; Swiss Re, 2001).

The reinsurance activities are, by nature, more geographically diversified. Although the reinsurance market has long had a significant global component, the consolidation through mergers and acquisitions (M&As) during the 1990s has significantly increased the degree of globalization. The surge was originally motivated by the underestimation of insurance exposure to natural disasters as well as by an increase in the demand for reinsurance for non-catastrophic losses and vulnerability to the frequency and severity of claims. Cummins and Weiss (2000) explained that the covariability of risk in local markets can be reduced by diversifying internationally. Reinsurance companies have increased their foreign direct investment and acquired other companies in part because it is the fastest way to achieve meaningful diversification, but also because they believe that only very large players will have the cost advantages necessary to remain competitive in global markets.[5]

At the end of 2010, the leaders are still Munich Re (established in 1880) and Swiss Re (established in 1863) but the followers are closing up the gap (see table 1). Berkshire Hathaway as a group includes the activities of General Re since 1998. In 1994, General Re had already acquired Cologne Re, the world oldest reinsurance company established in 1846. Hannover Re, created only in 1966, moved up scale from the 18th place with several M&As including HIR (Hamburger International Re) in 1990, Eisen & Stahl in 1995, Skandia Re in 1996. The newcomers are not necessarily new entities. Everest Re founded as Prudential Re changed its name in 1996 to be incorporated in Bermuda. PartnerRe was created in 1993 and acquired SAFR in 1997 and Winterthur Re in 1998. NKSJ is the result of the recent merger of Nipponkoa Insurance with Sompo insurance, the former having already merged in early 2010 with Mitsui Sumitomo Insurance.

Looking at the top 20 list in 1980, it appears that Swiss Re was actively involved in the consolidation of the reinsurance business through successive M&As. The activities of

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[4] The increased M&A activity raises important research and policy questions about the causes and consequences of consolidation in the financial services industry. Berger et al. (2000) surveyed hundreds of papers on the causes and consequences of consolidation, covering the topics of efficiency, market power, managerial and government motives and consequences.
[5] Diversification in the reinsurance industry is nothing new but several reasons have recently increased the focus on diversification: 1) the increased frequency and severity of catastrophic risks, 2) the sophistication of capital markets and, 3) regulatory developments concerning capital adequacy. On reinsurance, see also Weiss and Chung (2004).

Mercantile and General were merged in the group in 1996. Employers Re which had acquired Frankona Re (established in 1886) became part of GE Insurance Solutions in 1984 and was bought by Swiss Re in 2005. During the same period, Swiss Re also acquired in 1997 UIR (Unione Italiana Di Riassicurazione) and Bayerische Re was integrated into Swiss Re in 1998. America Re, acquired by Munich Re in 1996, was fully integrated in its parent company in 2006. NRG from the Netherlands was taken over by HDI (Hafpflichverband der Deutschen Undustrie) which became part of the Talanx group in 2000. When the Gerling Global group was put for sale in 2002, all the reinsurance activities were merged with Hannover Re and the Talanx group created an insurance division under the name HDI-Gerling. Finally, in 1981, the INA Corporation and the Connecticut General Corporation combined their operations to become the Cigna Corporation which sold its property-casualty domestic and international business in 1999 to ACE-Tempest ranking 24th in 2010. Cigna today is only focussing on its global health, life and pension businesses.

The strategic decision to expand activities in several foreign markets is implemented at the group level and this paper examines the activities of the world's largest reinsurance consolidated groups rather than single reinsurance entities registered in one country but considered as affiliates of larger worldwide groups. Obtaining comparable data for reinsurance companies around the world is a difficult task because of different reporting procedures. The review ReActions had worked with the International Insurance Solvency (IIS) to collect data on the world's largest reinsurance companies since 1986. When IIS became part of Standard & Poor's (S&P) in 1991 and since, a unique list of the largest reinsurance groups in the world has been published each year. Until 2002 only 150 companies were surveyed and consolidated data was only available for 25 reinsurance groups but since 2003, consolidated data for the 40 largest groups is available. This unique set of data on consolidated reinsurance groups provides information on net reinsurance premiums written, loss and expense ratios and return on revenues. The set of net reinsurance premiums data is used in this study and complemented by data on the number of majority owned affiliates and host locations of these affiliates.

This paper has several objectives. By examining the distribution of the total net premiums written by the largest reinsurance groups in the world, this paper documents several dimensions. The first is the documentation of the relative importance of the largest reinsurance companies in the world and changes that may have occurred in the past years (section 2). The second objective is to present the relative position of these companies by

home and host countries (sections 3 and 4). The third objective is to look at the recent situation and to explain the choice of foreign locations of reinsurance groups in expanding abroad (section 5). The fourth objective is to examine the relationship between geographical diversification and the performance for the world's largest reinsurance groups (section 6). It is verified that the form and nature of the relationship between international diversification and performance follow an S-shaped curve with increased diversification of the largest reinsurance groups.

Table 1 here

2. The globalization trend of the largest reinsurance companies

The total of net reinsurance premiums written by the largest groups in the world in 2010 is estimated by S&P to nearly US$160 billion. As mentioned in the introduction, prior to 2003 only 150 companies were surveyed by S&P to calculate the total amount of net premiums. It is therefore possible to observe a break in trends concerning the concentration of the reinsurance activities prior and after 2003.

Despite these limitations, calculating market shares remains the most accurate presentation of the relative position of the largest reinsurers in the world and this information can also be used to construct measures of the relative positions of countries as reinsurance centers. This section presents the results of static measures of concentration, all based on the market shares q_i of each company derived from the proportion of total net premiums written.

The first static measure is the well-known Herfindahl-Hirschman index: $H = \Sigma \, [q_i]^2$
The advantage of this measurement is that it makes it possible to calculate a "number equivalent" of companies ($N^* = 1/H$) where N^* is the potential number of companies of the same size which could exist on the market for a given degree of concentration.

The second measure is Kwoka's (1977) Dominance index: $D = \Sigma \, [q_i - q_{i+1}]^2$
This emphasizes the gap between successive firms when they are ranked by size. The values of this measure range from 1 to 0, with the former value indicating a monopolistic market. Conversely, the closer to zero the measure is, the lower is the power of any single company.

Other dynamic measures of concentration reflecting changes have also been developed. Hymer and Pashigian (1962) developed an index of market share instability: $I = \Sigma \, [q_i - q_{i,t-n}]$

The higher the value of I, the greater the degree of change in market shares over the period, and by implication, the greater the competitive turbulence and the amount of entry and exit.

Dynamic measures are not used in this paper but Outreville (1998) calculated these measures for the top reinsurance companies for the sub-periods 1987-1990, 1990-1993 and 1993-1995 and found an increase in market shares instability in the early 90s corresponding to the increased M&A activity during this period. To remain consistent other the period of time and with previous work (Outreville, 1998 and 2003) the concentration measures are calculated for the 25 largest reinsurance groups (table 2). Nevertheless, this assumption represents for most of the years covered by our analysis, more than 90% of the world market (table 2).

Observation of the measures of concentration (k-firms ratios) in table 2 reveals that the market shares of the five largest groups have significantly increased between 1999 and 2009. The last year is an exception in this trend and it may be interesting to wait one more year to confirm this result. The value of the Herfindahl index as well as the number equivalent of companies also reflects this increased concentration. The Kwoka's dominance index, which was relatively stable until 2001, has slightly increased between 2003 and 2009, indicating a larger spread between the largest groups and the followers.

Table 2: Concentration measures for consolidated groups, 1999-2010

Year	1999	2001	2003	2005	2007	2009	2010
K-firms concentration							
Top 3	45.7	44.9	45.9	47.0	50.8	48.5	43.9
Top 5	59.6	59.2	58.7	60.8	63.7	63.7	60.0
Top 10	79.9	79.9	75.9	73.7	80.1	81.5	79.0
Total net premiums (Mil.$US) of Top 25	78,412.0	95,577.0	143,630.0	128,857.0	148,184.0	145,478.0	144,462.0
Percentage of World Total (estimated)	94.5%	97.5%	87.8%	87.8%	91.0%	91.0%	91.0%
Herfindahl index	0.0928	0.0925	0.0967	0.1038	0.1075	0.1087	0.0937
Number equivalent	11	11	10	10	9	9	11
Dominance index	0.0046	0.0051	0.0096	0.0084	0.0087	0.0109	0.0070
Source: Standard and Poors', several years.							

3. Home countries

The geographic distribution of reinsurance companies shows that since the early 2000s, only 5 countries accounted for more than 80% of the world reinsurance premiums (table 3). During the past thirty years, reinsurance groups from only three countries (Germany, United States

and Switzerland) have dominated the reinsurance business worldwide with more than 60% of total reinsurance premiums. Since the early 2000's, Bermuda has emerged as a major reinsurance center. Reinsurance originating from emerging economies only accounted for about 1.4% of the world reinsurance premiums in 2003, with the Korean Re. Three economies (Korea, India and Brazil) are host countries of a major reinsurance group listed in the top 40 since 2006 and accounted for 3.3% in 2006 and to a meagre increase in 2010 (3.6%).

Table 3: World market share of reinsurance groups by home countries, 1999-2010

Home country	1999	2001	2003	2005	2007	2009	2010
Germany	29.8	32.5	27.1	22.5	26.4	30.2	28.4
United States	26.7	24.7	19.1	20.9	19.9	17.6	19.1
Bermuda	2.3	4.7	11.3	16.2	12.9	13.8	15.8
Switzerland	18.8	19.1	17.5	15.7	17.7	14.3	13.1
United Kingdom	4.8	6.1	4.8	4.5	5.6	6.7	6.7
France	5.9	7.4	4.4	3.8	5.8	6.3	6.2
Japan	2.3	1.9	6.1	5.9	6.2	4.7	4.4
Rest of the world	9.4	3.6	9.7	10.5	5.5	6.4	6.3
Source: Standard and Poors', several years.							

4. The international presence of the largest reinsurance groups

The degree of international involvement of a firm can be analyzed from a number of perspectives: their operations, stakeholders and the spatial organization of management. Given the range of perspectives and dimensions that can be considered for each, the degree of internationalization of a firm cannot be fully captured by a single synthetic measure.[6] In this section, the international dimension is captured by the existence of foreign affiliates and the number of host countries in which a reinsurance group is established.

Information on the number of majority owned foreign affiliates and number of host countries is provided by Dun & Bradstreet, *Who Owns Whom* database. The number of host countries is an average value over the period 2006-2008 and the largest groups are ranked by net premiums in 2008 (table 4). Casual observation of the top 25 groups, which accounted to 91% of the world business in 2008, seams to reveals a significant relationship between the size of the group and the number of host countries with majority-owned affiliates but the calculated Spearman rank correlation (rho, p-value) is only equal to (0.51, 0092) for the full sample. If we drop the last two groups from the list, it increases to (0.71, 00007).

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[6] For recent work on multidimensional measures of internationalization see, for instance Goerzen and Beamish (2003) and UNCTAD (2007).

The average number of host countries is 13 for the world's 25 largest groups. Japanese firms have, on average, a much lower number of host countries (6).

Research in different disciplines has sought to explain when and why firms invest in foreign countries. Conventional internationalization theory suggests that international expansion rise because firm possess ownership-specific and internalization advantages, which can be exploited profitably across national borders. Geographic and cultural distances have received a great deal of attention in the international business literature and have been identified as a key factor in explaining foreign market attractiveness (Kogut and Singh, 1998). Johansson and Vahlne (1977, 1990) argued that firms expand first in geographically proximate markets and as experiential learning is built up, firms venture into more distant markets. The case of Korean Re is a good validation of this hypothesis. Companies from the United States have a dominant presence in Europe and Asia. German and Swiss groups have the same pattern of investment in Europe, Latin America and Asia. Spain (Mapfre) has a network of branches or affiliates in almost all LAC countries for obvious ethnic and cultural ties reasons. Japanese groups are more present in Asia (table 5).

Table 4: Number of host countries for foreign affiliates of the largest groups, 2008

Rank 2008	Group	Country	Number of host countries Average 2006-2008
1	Munich Re	Germany	34
2	Swiss Re	Switzerland	23
3	Berkshire Hathaway Re	United States	24
4	Hannover Re	Germany	14
5	SCOR	France	14
6	Lloyds	United Kingdom	16
7	Reinsurance Group of America	United States	10
8	Transatlantic Holdings (AIG)	United States	45
9	Partner Re	Bermuda	6
10	Everest Re	Bermuda	3
11	Tokio Marine (Millea Holdings)	Japan	15
12	XL Re	Bermuda	12
13	Korean Re	Korea, Rep. Of	2
14	Odyssey Re	United States	8
15	Transamerica Re (AEGON)	United States	13
16	Mitsui Sumitomo Group	Japan	10
17	Mapfre Re	Spain	28
18	Sompo Insurance Group	Japan	5
19	Caisse Centrale de Reassurance	France	0
21	Toa Re	Japan	3
21	White Mountains Group	Bermuda	3
22	AXIS Capital Holdings	Bermuda	3
23	General Insurance Corp.	India	1
24	QBE Insurance Group	Australia	14
25	ACE Tempest Re	Bermuda	19

Source: Standard and Poor's for the names and Dun & Bradstreet Who Owns Whom database for host countries

Table 5: Geographical repartition of affiliates of the largest groups by home countries

(based on the number of companies for which geographical breakdown is available)

Home Country	**Host Region**				
	Europe	CEE	Africa	LAC	Asia&Pacific
United States	43.8	1.8	5.3	10.5	38.6
Germany	45.5		4.5	18.2	31.8
Switzerland	44.1	2.9	2.9	17.6	32.5
Spain	42.8			50.0	7.2
Japan	34.0			11.6	54.4

LAC = Latin America and the Caribbean

CEE= Central and Eastern Europe (the ex-USSR)

5. A simplified model of location-specific advantages

According to the literature on the determinants of foreign expansion, firms will prefer those countries that provide greater location-specific advantages. Institutional characteristics of the destination country also play a crucial role in the pattern of internationalization.[7] There have been only a few empirical studies about the determinants for home country firms in financial services to expand abroad.[8] In the insurance literature, Moshirian (1999), Ma and Pope (2003) and Outreville (2008) have examined the determinants of insurer's international activities. Cole, Lee and McCullough (2007) provided a comprehensive approach to the decision process of US reinsurers to assume from foreign insurers. The location-specific advantages[9] have been examined by Outreville (2008) according to a similar following functional form:

LI = f (size of the market, growth, human capital, governance, trade barriers)

Location intensity (LI) is defined by UNCTAD (2007) as the number of reinsurance groups having at least one affiliate in the country concerned, divided by 100, minus the number of groups originating from this country, i.e. a firm from country A cannot have foreign affiliates in country A. Based on this measure, the largest number of groups has foreign affiliates in the United Kingdom, followed by the United States. Among emerging economies, Singapore, Hong Kong (China) and Mexico are ranked in the top 10 (appendix 1).

The size of the host economy is usually measured by its GDP and population. Since the size of the insurance market is a major determinant for a reinsurance company, insurance penetration (premiums as % of GDP) is used in the model.

Labor is another factor important to foreign investors. Thus, a high level of human capital would positively attract foreign firms. Human capital (or high levels of education) has not received any particular attention in the determinants driving FDI with the exception of Focarelli and Pozzolo (2005) and Outreville (2008). Following the results of the recent empirical literature on the determinants of growth, they assume that countries with highly skilled workers are more likely to attract FDI in financial services.

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[7] Clarke et al (2001) provide a useful summary of some of the main determinants of bank FDI in emerging markets. See also a more recent paper by Wezel (2004).

[8] Focarelli and Pozzolo (2005) are looking at the number of foreign affiliates of OECD banks.

[9] See Rugman and Verbeke (2004) for a definition.

In recent years there has been a surge of interest in the consequences of governance or misgovernance for development and how a country risk could have an impact on global investment strategies by transnational corporations. The importance of good governance in the financial sector (both public and corporate) has been highlighted by crisis in Asia, Russia and some Latin American countries. Corruption is commonly defined as the abuse of public office for private gain.[10] Governance is a much broader notion, which is defined as the traditions, and institutions that determine how authority is exercised in a particular country. This includes (i) the process by which governments are selected, held accountable, monitored and replaced; (ii) the capacity of governments to manage resources efficiently and formulate, implement and enforce sound policies and regulations; iii) the respect of citizens and the state for the institutions that govern economic and social interactions among them (Kaufmann et al. 2000).

Beyond the simple decision of whether foreign entry is allowed or not, foreign reinsurance companies are more likely to establish subsidiaries or affiliates in locations with fewer restrictions on their activities. Research into the measurement of services trade barriers is fairly recent. In banking, Claessens and Glaesner (1998) calculate "degree of openness" indices for financial services in eight Asian economies. McGuire and Schuele (2001) construct trade restrictiveness indices for banking services. Both studies report a significant correlation between GATS measures of commitments and actual practices of countries

The empirical analysis and results

The estimation procedure is an ordered probit analysis, which is a generalization of the linear regression model to cases where the dependent variable is ordered. The dependent variable is also bounded between zero and 100 by construction. Results of the estimation for a subset of 41 countries[11] are presented in table 6. They suggest that the decision to select a location is impacted by the size of a country measured by its population and the relative size of the insurance sector. As suggested by Rossi and Volpin (2004), GDP growth is used as a control factor but shows a small negative and non-significant value.

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[10] See Habib and Zurawicki (2002) for a survey of the literature.
[11] Bermuda has been excluded from the original list of 42 economies for lack of information.

The Human Capital Index (HCI) used in this study is a weighted average of the literacy rate and enrolment ratios (secondary school and tertiary education) calculated in UNCTAD (2005). The variable exhibits the wrong sign and is not significant.

The Government effectiveness index published by the World Bank Institute, combines perception of the quality of public service provision, the quality of bureaucracy, the competence of civil servants, the independence of the civil service from political pressures, and the credibility of the government's commitment to policies. It is one of the six indices published by WBI on governance.[12] Findings are consistent with the arguments presented in the literature and suggest that location-specific factors including good governance are important determinants in the choice of a location.

The higher is the index for regulatory barriers, the higher is trade efficiency or lower are the trade restrictions in the country. Due to the high correlation between governance (measured by government effectiveness) and trade efficiency (see the appendix 2), this variable is not significantly impacting on the choice of a location whereas the governance index remains significant. If only trade efficiency alone is left in the equation, it becomes significant as it pickups at the same time for trade efficiency and good governance.

Countries where entry would entail the least information costs are those most likely to be chosen as host countries. Information costs are most usually proxy by geographic and cultural distance (Ball and Tschoegl, 1982; Grosse and Goldberg, 1991; Buch 2000). Similarly, countries where the development of information and communication technology (ICT) is higher are those most likely to be chosen since ICT reduces both geographic and cultural distances. The impact of ICT on economic performance and trade competitiveness of countries has been heavily studied (UNCTAD 2005). Results of the estimation including a variable measuring internet users per 100 inhabitants are presented in the last column of table 6 and show a positive and significant impact of ICT on the choice of a location.

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[12] Available at www.worldbank.org/wbi/governance. This variable has been selected to differentiate government governance from political, financial or corruption risk. It is also considered by some authors as a dummy variable to determine the potential regulatory environment.

Table 6: Results of the Ordered Probit Estimation

sample size = 41	Coefficient	z-Statistic	Coefficient	z-Statistic	Coefficient	z-Statistic
Penetration (Premiums as % GDP)	0,105	1,69	0,105	1,68	0,087	1,39
Log (Population)	0,691	4,24	0,676	4,01	0,726	4,53
GDP growth (1992-2003)	-0,028	-0,28	-0,03	-0,3	..	..
Human Capital (HCI)	-0,843	-0,72	-0,989	-0,79	..	..
Good Governance	1,115	3,18	1,254	2,32	0,671	1,81
Trade Barriers	..	..	-0,111	-0,34	..	..
Internet users					0,022	1,43
note: Convergence was achieved after 8 iterations						

Data limitation

Several other variables do affect the choice of a location by a reinsurance group including distance as defined before, historical reasons, tax and legal factors, portfolio analysis. The purpose of this analysis is to verify common location-specific factors. Furthermore, the small size of the sample reduces the ability to introduce too many variables at the same time in the model and data availability is limited for some countries.

6. The relationship between international diversification and performance.

The increased M&A activity raises important research and policy questions about the causes and consequences of consolidation in the financial services industry. Berger et al. (2000) surveyed hundreds of papers on the causes and consequences of consolidation, covering the topics of efficiency, market power, managerial and government motives and consequences. The banking production literature seems to argue that M&As have some limited potential to increase performance (Berger et al., 1993; Miller and Noulas, 1996; Haynes and Thompson, 1999).

The literature on firm diversification (particularly in the United States) suggests that the costs associated with diversification exceed benefits but there is no consensus on this claim.[13] The association of diversification with a loss of firm value, called "the diversification discount", is verified for financial firms.[14] Laeven and Levine (2007) found that the market value of banks that engage in multiple activities is much lower than for specialized banks.[15] Besides the diversification in product and line of service dimensions, there is also a trend toward diversifying geographically (Deng and Elyasiani, 2008). Most of the studies on scope or scale

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[13] See survey by Martin and Sayrak (2003) and a recent paper by Glaser and Müller (2010).
[14] A survey paper on business groups by Khanna and Yafeh (2007) examine this relationship.
[15] DeLong (2001) found that more value has been created through focussing mergers than diversifying mergers.

economies within financial service industries find no substantial supporting evidence (Berger et al., 2010).

In the insurance literature, the relationship between product diversification and performance has also received significant attention with mixed results. For example, Cummins et al. (2010) found a weak support for economies of scope and concluded that a focus strategy was a more efficient option than the conglomerate strategy. Additional support for the focus strategy is presented by Liebenberg and Sommer (2008). Elango, Ma and Pope (2008) found a nonlinear relationship between product diversification and firm performance. The results indicate that the relationship is significantly affected by the levels of geographic diversification.

However, this line of research is considering diversification of activities without examining the internationalization aspect.[16] This importance of international diversification comes from the fact that it represents a growth strategy that has major potential impact on firm performance. Moshirian (1999) found that premium growth and strategic diversification were the basic motivations to seek transnational activities.

Despite the numerous studies that have examined the diversification-performance relationship in the manufacturing sector, these efforts have provided evidence of conflicting results as noted first by Annavarjula and Beldona (2000). While early empirical research was mostly based on linear or quadratic models, now several authors have postulated a multi-stage approach, called 3-stage theory, based on a sigmoid model (Contractor, Kundu and Hsu, 2003; Lu and Beamish, 2004; Thomas and Eden, 2004; Chiang and Yu, 2005).

The overall shape of the relationship between the performance (P) of a firm and the degree of international diversification (measured by the degree of internationalization -DOI-) may be capturing different stages of foreign expansion and data may be capturing only part of an overall function (Contractor 2007). Depending on which part of figure 1 we examined we can find U-shaped and inverted U-shaped segments.

In stage 1, a firm initially seeks expansion of its business only in familiar and proximate markets.[17] As mentioned earlier, firms expand first in geographically proximate markets and as experiential learning is built up, firms venture into more distant markets (Johansson and
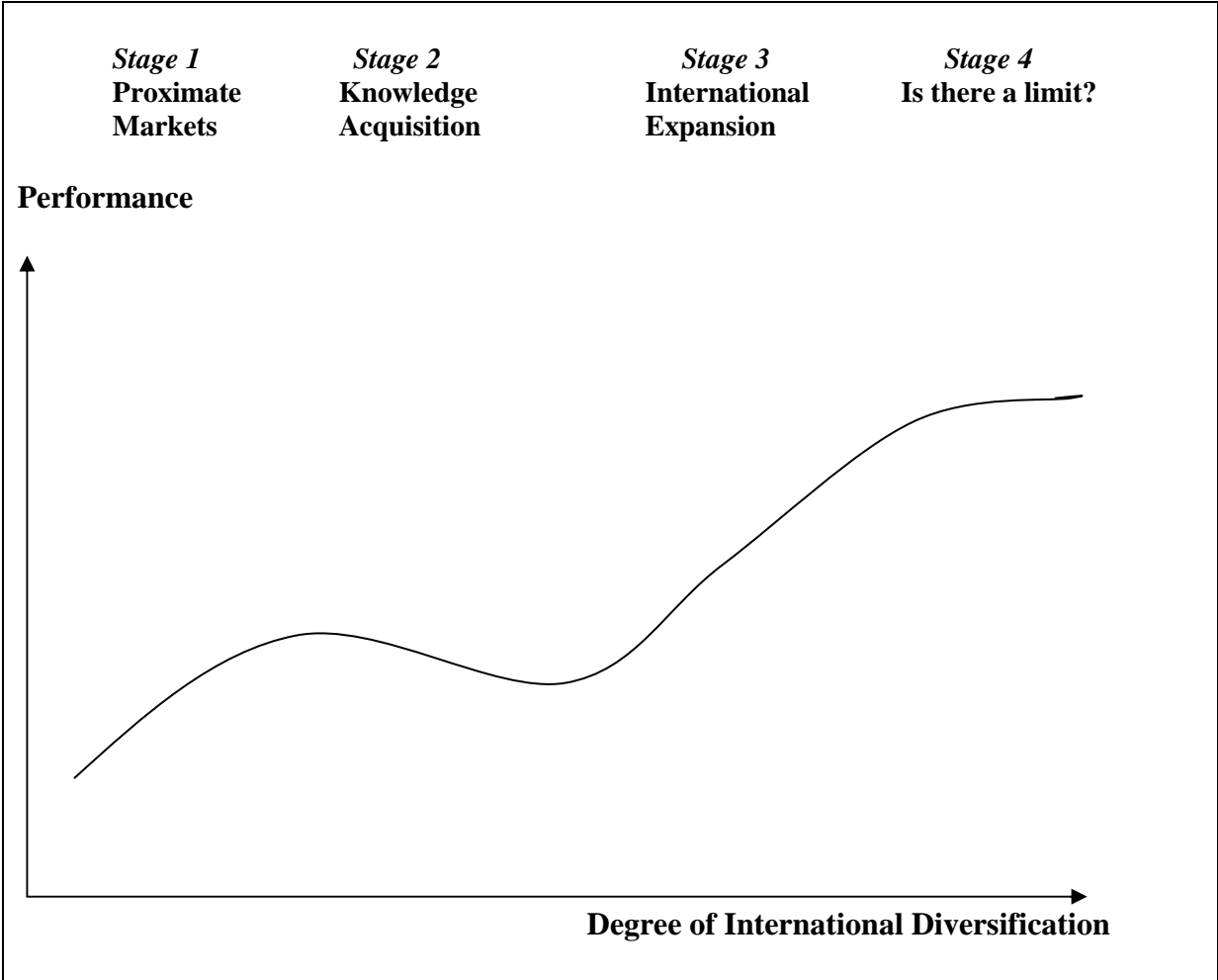
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[16] One exception is a paper by Schmid and Walter (2008).
[17] The role of knowledge acquisition costs relating to foreign expansion is treated explicitly in Johansson and Vahlne (1990).

Vahlne, 1977 and 1990). Experience and a firm's performance in close foreign markets are also relevant to support this hypothesis (Delios, 2011).

Figure 1: A theory of international expansion

Stage 1	*Stage 2*	*Stage 3*	*Stage 4*
Proximate Markets	**Knowledge Acquisition**	**International Expansion**	**Is there a limit?**

Performance

Degree of International Diversification

In stage 2, the number of different legal, fiscal and cultural environments that the firm has to deal with increases transaction and governance costs (Hitt et al., 1997; Gomes and Ramaswamy, 1999). According to Doz el al. (2001) there are significant costs of learning about a new market, as well as local adaptation costs. Therefore, expansion into new international operations generate at the beginning greater costs than the incremental benefits or revenues. This hypothesis is consistent with papers findings no improvement in cost efficiency in the years following merging activities (Altunbas, Molyneux and Thornton, 1997; Peristiani, 1997).

However, as the firm expands its international presence it is likely to benefit from exploitation of economies of scale and scope so that further international diversification will have a

positive effect on firm performance. In stage 3, further geographical scale and knowledge acquisition makes possible efficiencies that improve performance indicators. Incremental benefits are now greater that the incremental costs. But are the benefits of further international expansion indefinitely positive? As noted by Contractor (2007), the length or duration that a firm may spend in the different stages is a subject that remains open to research. There are a substantial number of papers that support the idea that being large and multinational enables a company to establish its standards and create a global brand name. Geographical diversification can be an advantage to reduce the volatility of risks and market power is seen a necessary condition for enjoying financial strength required by market developments.

Contractor, Kundu and Hsu (2003) suggested that the relationship between international diversification and performance may follow an S-shaped curve. Outreville (2010) validated a similar model for a sample of large financial groups. Following this approach, this paper will introduce linear, quadratic and cubic terms to test whether different stages may coexist.

Performance $P = f$ (size, growth, DOI, DOI^2, DOI^3)
    with DOI = Degree of internationalization.

Performance can be measured as Tobin's Q or using accounting data. Many researchers make use of accounting data (e.g. ROA, ROE, ROS or ROR) in empirical studies on the internationalization-performance relationship.[18] The argument in favour of using this type of data is that it is relatively easily available in databanks. In keeping with the insurance literature, performance in a broader sense is measured by the return on revenue (ROR).[19] Whereas ROR serves as the basic financial performance variable, we also use a risk-adjusted form of the variable ROR, as an alternative measure of financial performance. The measurement is calculated by dividing a company's average ROR by its standard deviation of ROR over the same period as proposed by Elango, Ma and Pope (2008).[20]

The degree of internationalization (DOI) can be analysed from a number of perspectives: the operations, stakeholders or the spatial organization of management. Internationalization is a function of the extent to which a firm's activities are located abroad. The degree of international involvement of a firm can be measured in terms of the share of foreign assets,

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[18] Due to data limitations it is usually extremely difficult to take into account the market impact of each line of business in the insurance and reinsurance sector as described in Lang and Stulz (1994).
[19] Standard & Poor's defined ROR as the ratio of pretax operating income over total revenue. Total revenue = net premiums earned + net investment income + other income).
[20] This measure is an approximation of the Z-index based on accounting data and proposed by De Nicoló et al. (2004).

sales or employment. These measures do not consider the spatial organization of the operations nor the diversification among countries. Given the range of perspectives and dimensions that can be considered for each, DOI of a firm cannot be fully captured by a single synthetic measure.[21]

In the reinsurance sector, data on the foreign operations (assets, income, and employment) of the companies is not readily available even when looking at annual reports. Similarly, the breakdown of business by countries for the largest groups is not available and it is therefore not possible to calculate a Herfindahl Index of business diversification.[22] In this paper, DOI is defined as a function of the extent to which a firm's activities are located abroad and is captured by the number of majority owned foreign affiliates and the number of host countries in which a company has established its affiliates. We follow the concept defined by UNCTAD (2006), i.e. the Geographical Spread Index (GSI) measured as the square root of the Internationalization Index (the number of foreign affiliates divided by the total number of affiliates) multiplied by the number of host countries.[23]

International diversification comes from the fact that it represents a growth strategy that has major potential impact on firm performance. This strategic decision to expand activities in several foreign markets is implemented at the group level. In performing the econometric analysis and in line with previous studies on the internationalization-performance link, we control for two key variables, i.e. firm size and growth (Gomes and Ramaswamy, 1999; Moshirian, 1999). Firm size is measured by the log of total assets. Growth is measured by the increased in total net premiums over the period.

A company cannot isolate itself from the home country effects as it incurs a complex set of costs and benefits from its home base operations. Hitt et al. (1994), Sethi and Elango (1999) or Ruigrok and Wagner (2003) suggested that one potential reason for differences in empirical findings across studies could be the country of origin of the multinational company. Due to the differences in regulations it is important in our study to segregate between US-based and

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[21] For recent work based on multidimensional measures of internationalization see, for instance, Fisch and Oesterle (2003), Goerzen and Beamish (2003), UNCTAD (2007).

[22] The Herfindahl index of geographic diversification based on NAIC data and used in Elango, Ma and Pope (2008) or Cummins et al. (2010) considers geographic diversification within the United States were foreign entities are defined as out of state groups (not out of the United States). Information on aliens' entities is more difficult to assess for some reinsurance groups in our list.

[23] The debate on the best approach to measure DOI is not closed. See Christophe and Lee (2005).

Europe-based reinsurance groups. Dummy variables are used to capture of the effect of the major home countries of the reinsurance groups in the sample.

The empirical analysis and results

Standard & Poor's publishes a list of the 40 largest reinsurance consolidated groups in the world each year since 2003 and only 28 groups ranked that year are still ranked in the 2007 publication. To maximize the number of groups for which accounting data was available for the empirical analysis, the period was limited to the year 2005 and included 25 groups (appendix 3). Information on the number of majority owned foreign affiliates and number of host countries is provided by Dun & Bradstreet, *Who Owns Whom* database.[24] In keeping with the insurance literature, performance is measured by the return on revenue (ROR) over the period 2001-2005.

Pure cross-sectional analysis based on OLS is used to test the relationship on the average value of ROR and the risk-adjusted value. Although intercorrelation among variables was sufficiently low, these variables can explain only a part of the financial performance of reinsurance groups and low adjusted R^2s were expected. Nevertheless, all models are strongly significant with high F-values. Comparison of F-values and adjusted R^2s indicate that results generally improved when the cubic variable DOI^3 was added to the quadratic specification. The variance inflation factors (VIFs) in all our regressions are lower than 5.0 indicating low multicollinearity. We acknowledge that the sample is small but we check for robustness and adding/deleting randomly one observation does not drastically change the conclusion. The results are more stable than expected.[25]

Table 7 (a and b) reports the results of the performance model when both the number of host countries and the GSI index are used as a measure for DOI. The model is estimated in three stages for the impact of DOI. As expected size is positively related to performance and this result supports the recent findings of Liebenberg and Sommer (2008) and Elango et al. (2008). The growth variable is also positive and significant as expected from the results in international business (Glaum and Oesterle, 2007). International diversification measured by

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[24]   Out of top 40 Global Reinsurance Groups published by Standard and Poor's, detailed information published in annual reports or by Dun & Bradstreet, was only available for 25 groups.
[25]   This procedure is equivalent to sampling without replacement by comparison with sampling with replacement, which would result in a bootstrap sample. Bootstrapping would probably be a better way to deal with this case of small sample.

the geographical spread index (GSI) exhibit the expected signs: positive, then negative for the quadratic term and positive again for the cubic term. The number of host countries is never a significant indicator of DOI. The linear model is never significant; the quadratic model exhibits the expected signs but coefficients are not all significant; the cubic term not only is significant, but also adds to the overall results. Although limited to geographic diversification within the United States, the results of Elango et al (2008) also support the impact of this variable on firm performance.

Table 7: Performance Model: Average ROR, sample size=20

Table 5a with nb countries		Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
Constant		-31.52	-3.29	-32.23	-3.28	-34.69	-3.61
Size (Log Assets)		2.72	2.79	2.72	2.73	2.62	2.73
Growth of net premiums		9.30	4.44	9.26	4.34	10.23	4.74
Nb countries		-0.33	-2.48	0.15	0.48	0.76	1.16
Nb countries**2				-0.05	-0.63	-0.77	-1.76
Nb countries**3						0.13	1.47
R**2 / F		0.59/7.83		0.61/5.75		0.66/5.39	

Table 5b with GSI		Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
Constant		-20.47	-2.20	-30.27	-2.98	-38.55	-3.73
Size (Log Assets)		1.56	1.64	2.03	2.21	1.84	2.15
Growth of net premiums		8.44	3.58	8.94	4.04	10.64	4.77
GSI		-0.11	-1.01	0.43	1.41	1.98	2.29
GSI**2				-1.17	-1.86	-8.86	-2.17
GSI**3						9.96	1.90
R**2 / F		0.47/4.78		0.57/5.00		0.66/5.41	

For reinsurance companies, diversification is a useful by-product of a well-constructed portfolio because the risk-adjusted return - all other things being the same - will be greater than the risk-adjusted return on a non-diversified portfolio. We would expect international diversification to have a significant impact on the overall risk of the portfolio. Analysis of the risk adjusted measures over the period (table 8) does not provide any conclusive result contrary to the results of Elango et al (2008). The coefficients have the expected sign but none is significant. Results with the number of host countries as an indicator of DOI are not significant either and are not reported here.

Table 8: Performance Model: Risk-adjusted measures

Variable		ROR	
		Coefficient	t-Statistic
Constant		69.28	1.86
Size (Log Assets)		-4,40	-1,39
Growth of net premiums		-0,74	-0,15
GSI		-1,00	-0,28
GSI**2		1.88	0.12
GSI**3		0.28	0.01
R**2 / F		0.175/0.722	

Note: GSI is the measure of DOI adopted in this empirical validation

Several other variables do affect the relationship between performance and international diversification including tax and legal factors. The Hitt et al. (1994) hypothesis that the home country of the multinational firm can explain differences in performance is not confirmed since none of the dummy variables tested are significant. Only Japan-based reinsurance groups enjoyed a performance advantage (significant only at the 15% level) (table 9). Japanese reinsurance groups are only present in a few countries mainly in East and South-East Asia where the return on insurance business is more stable and significantly higher than in the rest of the world.

Table 9: Dummy variables for country of origin

		Coefficient	t-Statistic
Constant		-37,46	-3,57
Size (Log Assets)		1.31	1.32
Growth of net premiums		11.83	4.54
GSI		2.21	2.10
GSI**2		-9,28	-2,01
GSI**3		10.69	1.82
Dummy Berrmuda		-0,14	-0,04
Dummy Japan		3.68	1.25
Dummy US		-2,78	-0,74
R**2 / F		0.73/3.67	

Note: GSI is the measure of DOI adopted in this empirical validation

A similar test was performed to verify if an increasing number of host countries bring similar results (table 10). Although the results are not statistically significant, the sign of the variables corresponds to the expectations. Firms having foreign affiliates in up to 5 host countries (generally proximate markets) enjoyed a performance advantage. Firms having foreign affiliates in 6 to 10 host countries are experiencing high learning costs and lower performance. Firms having foreign affiliates in 11 to 15 host countries are still experiencing lower performance but with a decreasing estimated coefficient. Firms having foreign affiliates

in more than 16 countries enjoyed on average a performance advantage. Unfortunately, the sample is too small to determine at which stage the firm reaches an optimum diversification.

Table 10: Dummy variables for international diversification

		Coefficient	t-Statistic
Constant		-49,43	-3,25
Size (Log Assets)		2.13	2.29
Growth of net premiums		11.37	4.54
GSI		2.49	2.61
GSI**2		-9,45	-2,26
GSI**3		9.95	1.80
Dummy 1 to 5 countries		4.76	0.93
Dummy 6 to 10 countries		-0,88	-0,25
Dummy 11 to 15 countries		-1,11	-0,31
R**2 / F		0.72/3.58	

Note: GSI is the measure of DOI adopted in this empirical validation

Data limitations

The purpose of this analysis was only to verify the non-linearity of the relationship. Several other variables may affect the choice and number of locations by a reinsurance group. However, the small size of the sample reduces the ability to introduce too many variables at the same time in the model and data on the geographical international diversification of the largest reinsurance groups are collected for a single year and past annual reports of companies do not necessarily report the number and locations of foreign affiliates. Therefore it is not possible to examine the evolution of the number of locations overtime for the sample of companies used in this study, nor is it possible to calculate the Geographical Spread Index over several years.[26]

As argued by Hennart (2007), the firm's specific internationalization processes should be examined in relation to their performance over time. A longitudinal approach would be appropriate to test the relationship empirically but unfortunately it remains an impossible task to perform such an analysis. Due to data limitation on the degree of internationalization, balanced-panel data analysis pooling time-series and cross-sectional data points cannot be used to test the model.

7. Conclusion

Reinsurers' exposure to large catastrophe losses is one of the drivers behind the reduced financial strength of the industry and this is one argument in favour of M&As (Cummins and

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[26] Typically, the estimation may also overestimate the benefits of DOI due to unobserved factors (management, corporate governance) and accounting practices (smoothing earnings for market, tax or regulatory reasons).

Weiss, 2000). This paper documents the relative importance of the largest reinsurance companies in the world and changes that have occurred in the past thirty years. By looking at the trend in concentration, it shows that the largest reinsurance groups have significantly increased their world market share and dominance over the past thirty years as part of the belief that only very large players will remain competitive.

Another objective of the paper was to look at the diversification aspect and to explain the choice of foreign locations of reinsurance groups in expanding abroad. The results indicate that location-specific advantages such as size and good governance do provide an explication for the choice of locations by the largest reinsurance groups in their internationalization process.

The relationship between international diversification and firm performance also bring interesting results as significant differences exist on the efficiency side. The results show that, overall, international diversification is positive for a firm's performance. At an early stage of expansion in proximate markets there are efficiency gains for the firm. However, with increased internationalization there may be a diminution in performance because of initial learning costs. Further expansion in foreign markets brings back efficiency and higher performance. However, at this stage, the analysis cannot provide any answer to the existence or not of a maximum level of international diversification beyond which performance would decline. Constraints in data availability hindered this attempt.

The result of our study provide results that are different from previous studies in the manufacturing sector but which are close enough to the results by Contractor et al. (2003) for some service firms. International expansion may offers performance advantages to a reinsurance group but it is rarely the result of paced growth. Firms with strong competencies that they developed overtime in foreign markets can utilize these in further internationalization. Thus, it is difficult for a firm to assess when it is over-internationalized. Also firm may deliberately expand for long-term strategy reasons such as market share even though this is detrimental to medium-run performance. One additional feature that cannot be overlooked in the reinsurance sector is its continued dependence on the capital markets to fund capital shortfalls and future growth.

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Appendix 1: The most preferred locations by the largest groups

rank	All economies	Location intensity
1	United Kingdom	92,6%
2	United States	87,0%
3	Canada	78,6%
-	Singapore	78,6%
5	Japan	69,5%
6	France	61,5%
7	Australia	59,2%
8	Hong Kong (China)	57,1%
9	Italy	53,6%
-	Mexico	53,6%
11	China	50,0%
-	Germany	50,0%
-	Malaysia	50,0%
14	Spain	48,1%
15	Belgium	46,4%
16	Brazil	42,8%
-	Taiwan, Prov. of China	42,8%
18	Korea, Rep. Of	39,3%
19	Bermuda	36,4%
20	Argentina	35,7%
-	Ireland	35,7%
22	Switzerland	34,6%
23	South Africa	32,1%
24	Chile	28,6%
-	Colombia	28,6%
-	India	28,6%
27	Netherlands	25,0%
-	Sweden	25,0%
-	Thailand	25,0%
30	Austria	17,8%
-	Denmark	17,8%
-	Greece	17,8%
-	Indonesia	17,8%
-	New Zealand	17,8%
-	Poland	17,8%
-	Russia	17,8%
37	Vietnam	14,3%
38	Czech Republic	10,7%
-	Norway	10,7%
-	Peru	10,7%
-	Portugal	10,7%
-	Venezuela	10,7%

Appendix 2: Correlation matrix among variables

	Location Intensity	Penetration	Log(Population)	GDP Growth	Human Capital	Governance	Trade barriers
Location Intensity	1.00	0.47	0.24	0.10	0.17	0.41	0.29
Penetration	0.47	1.00	-0.25	-0.03	0.47	0.65	0.55
Log(Population)	0.24	-0.25	1.00	0.17	-0.50	-0.54	-0.57
GDP Growth	0.10	-0.03	0.17	1.00	-0.20	0.06	0.07
Human Capital	0.17	0.47	-0.50	-0.20	1.00	0.70	0.54
Governance	0.41	0.65	-0.54	0.06	0.70	1.00	0.89
Trade barriers	0.29	0.55	-0.57	0.07	0.54	0.89	1.00

Appendix 3: The World's Largest Reinsurance Groups, 2005
Ranked by Geographical Spread Index (Millions of dollars)

Rank	TNC	Home country		Spread Index	Total Assets	Net premiums
				(GSI)	2005	2005
1	Swiss Re	Switzerland		47.9	166,552	21,204
2	Munich Re	Germany		41.4	259,087	22,603
3	ACE Tempest Re	Bermuda		40.3	61,126	1,546
4	Mapfre Re	Spain		38.4	29,540	1,082
5	SCOR Re	France		30.5	4,440	2,692
6	QBE Insurance Group	Australia		30.3	13,929	1,190
7	XL Re	Bermuda		30.1	58,137	5,013
8	Hannover Re (Talank)	Germany		29.5	39,624	9,191
9	White Mountains Re	Bermuda		27.3	8,458	1,304
10	Berkshire Hathaway	United States		26.8	198,325	10,041
11	PartnerRe	Bermuda		25.8	13,744	3,616
12	Mitsui Sumitomo Insurance Co.	Japan		23.9	69,203	1,713
13	Millea (Tokio Marine&Fire)	Japan		23.1	108,430	2,789
14	Odyssey Re	United States		22.7	8,620	2,302
15	Transatlantic Holdings Inc.(AIG)	United States		22.0	4,242	3,466
16	Reinsurance Group of America	United States		19.8	16,140	3,863
17	Axis Capital Holdings	Bermuda		16.9	11,926	1,491
18	Sompo Japan Insurance Group	Japan		15.8	54,913	1,804
19	Aioi Insurance Co.	Japan		15.8	25,265	1,152
20	Converium Re	Switzerland		13.4	10,983	1,816
21	Lloyds	United Kingdom		11.2	103,290	6,567
22	Alea Group Holdings	Bermuda		9.1	3,111	736
23	Korean Re	Korea Rep. Of		7.1	2,419	1,947
24	Toa Re	Japan		7.1	2,197	1,211
25	Everest Re	Barbados		2.2	16,240	3,972

Sources: Standard & Poor's, Global Reinsurance Highlights, several years. Company's websites. Dun & Bradstreet, *Who Owns Whom* database.

Table 1 The Top 20 World's Largest Reinsurance Groups, 1980, 2000 and 2010

1980			2000		
Name	Home country	Premiums US$	Name	Home country	Premiums US$
Munich Re	Germany	3,836.0	Munich Re	Germany	15,276.6
Swiss Re	Switzerland	2,896.3	Swiss Re	Switzerland	14,478.8
Gerling Global Re	Germany	694.3	Bershire Hathaway	USA	8,574.7
General Re	USA	664.3	Employers Re	USA	7,924.0
Cologne Re	Germany	664.4	Hannover Re	Germany	4,994.3
Mercantile and General Re	UK	530.4	Gerling Global Re	Germany	4,117.0
SCOR	France	529.3	Allianz Re	Germany	3,726.5
Francona Re	Germany	476.4	SCOR	France	2,809.8
American Re	USA	363.7	Zurich Re	Switzerland	2,485.0
Prudential Re	USA	319.8	Transatlantic Re	USA	1,658.6
Bayerishe Re	Germany	311.2	AXA Re	France	1,424.7
Employers Re	USA	304.8	PartnerRe	Bermuda	1,380.3
NRG	Netherlands	290.2	St Paul Re	USA	1,251.5
INA Re	USA	287.6	Everest Re	Bermuda	1,218.9
H.I.R.	Germany	274.6	XL Re	Bermuda	1,022.2
Toa Fire and Marine	Japan	265.8	Korean Re	Rep. of Korea	977.5
U.I.R.	Italy	265.0	CNA Re	USA	951.0
Hannover Re	Germany	252.0	Toa Re	Japan	942.4
Eisen & Stahl	Germany	191.8	Hartford Re	USA	825.9
SAFR	France	189.2	Tokio Marine Group	Japan	705.3

Note: To facilitate the comparison among these years, Lloyds (ranking 5th in 2010) is excluded from the list

Source: 1980 = Argus International de l'Assurance, No 14, March 1982

2000 = Standard & Poors, Global Reinsurance Highlights 2001

2010 = Standard & Poors, Global Reinsurance Highlights 2011

| | 2010 | |
Name	Home country	Premiums US$
Munich Re	Germany	29,269.1
Swiss Re	Switzerland	19,433.0
Berkshire Hathaway	USA	14,669.0
Hannover re	Germany	13,652.2
SCOR	France	8,141.3
Reinsurance Group of America	USA	6,659.7
PartnerRe	Bermuda	4,705.1
Everest Re	Bermuda	3,945.6
Transatlantic Re	USA	3,881.7
Korean Re	Rep. of Korea	2,757.4
Tokio Marine Group	Japan	2,617.2
NKSJ (Nipponkoa & Sompo)	Japan	2,526.1
General Insurance Corp.	India	2,361.3
QBE Insurance	Australia	2,184.0
Mapfre Re	Spain	2,152.2
Transamerica Re (AEGON)	USA	2,037.8
XL Re	Bermuda	1,920.5
Odyssey Re	USA	1,853.8
AXIS Capital Holdings	Bermuda	1,815.3
Toa Re	Japan	1,798.7