Institute of Actuaries of India

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INDIAN ACTUARIAL PROFESSION
Serving the Cause of Public Interest

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ANNOUNCEMENT OF ONLINE COACHING CLASSES FOR THE SUBJECT CT4-MODELS

The Institute of Actuaries of India announces coaching classes for the subject CT4-Models for students appearing for October 2015 examinations.

The online coaching program offers 40 sessions each of 90 minutes duration covering concepts of Actuarial Modelling, practical applications and examination questions.

Candidates would be enrolled on a first-come first-served basis; preference to all candidates who have made failed attempts in the past and those who have cleared the subject CT3. A total charge of ₹15000.00 would be applicable for the course which needs to be paid at the time of registration of October 2015 examinations

METHOD AND SCHEDULE OF COACHING PROGRAM

- Classes would be conducted online, live; excel models, videos would be available as additional tools as appropriate.
- Videos of each of conducted sessions can be viewed from the IAI website for a period of 2 weeks after the live session
- Candidates may contact the teacher by phone to clear doubts, take advise during working days of IAI.
- Candidates may visit the IAI office with pre-appointment to have a face-to-face discussion on covered topics
- A mock examination would be conducted in Mumbai in October prior to the IAI examination; answer scripts would be reviewed and discussed with candidates.
- Classes will commence on 29th July, 2015
- Maximum of four sessions in a week
- Timings from 11.00 am.- 12.30 pm.
- The last session scheduled on 8th October, 2015
- Mock examination date would be announced later.

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25	09-09-2015	Chapter-8 Estimating the life time distribution function: Discussion of important questions and solutions
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ENROLMENT:

Students who are intended to appear for CT4-Models in the October 2015 examinations need to enrol their names on or before **20th July 2015** by submitting a registration form, a soft copy of the same may be obtained by contacting Vinodkumar@actuariesindia.org.

For any queries, please contact **Vinod Kumar, Head-Research at 022 6784 3319**

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MR. RAJESH DALMIA

Dear Members,

I was pleasantly surprised to see some emails coming from our members to the Institute. This is good news as it means that the members are taking keen interest in the activities of the Institute. Keep writing to us on anything that you liked or did not like as that is the only way to improve ourselves and to provide a better service to you.

The Actuarial Profession in India started when Actuarial Society of India was set up in way back in 1944. Since then the society was financially supported by Life Insurance Corporation and by a few members who took keen interest in the profession. The profession gained importance and came to limelight since the opening up of the Insurance sector which lead to a significant demand for actuarial skills in the country. With the increase in the demand the focus switched to the profession and the government also recognized the same.

The government found the profession to be very similar to the chartered accountancy profession and the first draft of the Act was nearly a copy of the Chartered Accountants Act 1949. Not that the final Actuaries Act 2006 is too different than the Chartered Accountants Act 2006. It is important to realize that both the professions though different, yet have quite a few similarities. Actuaries play a significant role in determination of nearly half of the balance sheet of Insurance Companies. In other jurisdictions, actuaries also play a significant role in audit of these balance sheets. Even in India, Institute has mandated a peer review system for review of major subjective elements which flow in determination of the half of the balance sheet.

The Accountancy Profession realized that auditor has to be independent of the entity which is being audited. They also realized that this independence has to exist not only between the chartered accountant who is carrying out the audit but also has to extend to the firm for which this chartered accountant is working. The profession recognized that they not only have to govern the chartered accountants but would also have to regulate the entities under whose umbrella these chartered accountants are working. Therefore, they ensured that partnership firms where all partners are chartered accountants are only allowed to take up the audit assignments. Of course, it was enabled by the provisions in the Chartered Accountants Act, 1949 which also exists in the Actuaries Act, 2006 (henceforth referred as "Act").

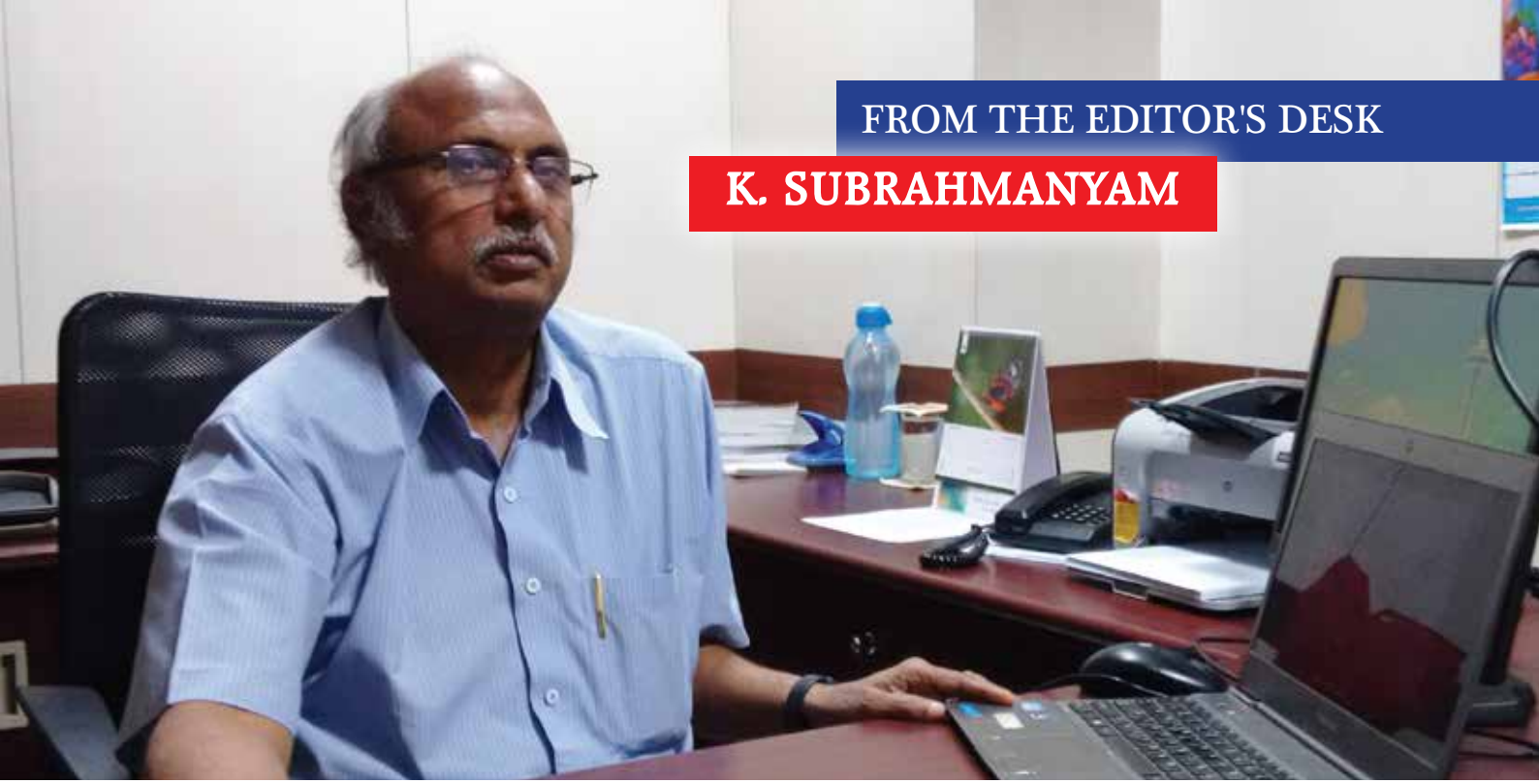
In India, the auditor does not audit half the balance sheet and relies on the work of the Appointed Actuary. In such a scenario, Appointed Actuary and peer reviewer carries a lot of responsibility. It is important that the independence is not compromised and peer reviewer (tomorrow it may be auditor) remains independent. Actuaries Act does not give power to the Institute to regulate the Companies just like Chartered Accountancy Act. However, similar to Chartered Accountancy Act, Actuaries Act also prohibits companies to practice as Actuaries. The Institute cannot ensure compliance with various practice standards and independence if it cannot govern the entities. Therefore, it is important that the actuaries who are members of the Institute are only allowed to carry out the actuarial practice. Since Institute can regulate the fellow members it is important to allow only those structures which can be governed through the governance of its members. Such structures are partnership firm (where all partners are actuaries in practice) or sole proprietorship (where proprietor is an actuary in practice) or independent member. Since, Institute can govern the partners or sole proprietor it is easy to see that it can also govern these entities. This is exactly the path followed by the chartered accountancy profession in India and this is exactly the arguments given by the standing committee of the parliament.

However, there is one difference. We do have Appointed Actuary system where Appointed Actuary certifies the liabilities and premiums. Appointed Actuary is an employee of a company. Therefore, the Act allows an employee of a company to be in practice. It came to the light of the Institute that some companies have interpreted this as companies are allowed to be in practice. The section 2(2) clearly begins with the words "Save as otherwise provided in this Act" where in it only allows an employee of a company to be in practice when that company is not in violation of the part "No company shall practice as Actuaries." In fact, the actuary violates this section if the company is in violation of that part as that actuary cannot be treated as actuary in practice.

It is important to understand crucial difference between an Insurance company and a consulting company. Insurance company do not market or sell actuarial services to its clients. Insurance company does not own an actuarial practice. In comparison, the consulting company markets actuarial services to its clients and owns this practice. The argument forwarded by companies practicing as actuaries is that the employee has signed the report in his individual capacity. Well, it gives rise to several questions like who is the owner of the practice, who has signed the contract with the client, who is paying the service tax for providing these services etc. The Institute has deliberated this and concluded that companies practicing as actuaries are in violation of the Act.

For any profession to flourish it is important that the rules and regulations are followed by the members. Similarly it is important that the body setting these rules and regulations follows the rules set for itself by the Act. If such a body itself does not follow the laws of the land then it does not have the right to govern its own members. Therefore, Institute would always adhere to the Act and will ensure compliance with the same.

All changes are painful even if it is for betterment. Exercise is good for health however it is painful to do the same. I can assure you that the council is taking a keen interest in the betterment of the profession and would love to hear more from you. Please feel free to write to us and be rest assured that your voice will be heard.



K. SUBRAHMANYAM

REMEMBERING SENIOR ACTUARIES

Aim of this article is to encourage members to follow the footsteps of late senior actuaries to become useful actuaries in the society. I worked in 1978 and 1979 with an eminent actuary late M C Chakravarti, who was a big consulting actuary in Kolkata; I interacted with: late B C Maitra, Late D Basu, Late P V Krishnamurthy, Late L P Venkataraman, Late R V Joshi. I had a chance to interact with Late Mr Dhurjati Subrahmanyam [the first Andhra Actuary], Late R S Rajan, Late R C Rao, Late K P Sarma, Late Guhagarkar, and many others. [I should write about them separately later]

Whenever I recollect the time I spent with them I become a bit emotional.

Mr Chakravarti was a very nice human being. He was the actuary who nurtured me and who made me understand the jobs of actuarial consultancy at a very young age. He was free to talk with us. In fact, he was the first man who gave me job. I traveled from Hyderabad to Kolkata to work under him in 1978, when I was 26. Besides actuarial skills, we learn a lot from their behavior to clients, actuaries, and others. In fact, he advised me never react in haste. Be calm; think systematically to solve the problem. He also taught me how to talk with clients.

Mr Maitra was a great man and who would calculate with precision. The way he estimated income and expenses for a no. of years in future, in those days [when we did not have computers and excel sheets] for a pension fund was marvelous. He never wasted a single minute in the office.

Mr Basu was such a lovely person, and a great human being. Nobody could forget him the way he expressed affection towards us.

Mr Krishnamurthy was a straightforward man. He never bent his head to anyone. He told me use your knowledge and experience gained in the past for good of the society. Do not be useless to the society sitting idle, wasting your actuarial talents.

Mr LPV was an exact actuary. His technical knowledge was superb.

Mr RV Joshi was an excellent person with lots of knowledge, who could speak incessantly on any subject. A gigantic personality. A Great human being. A fun loving man.

Mr D Subrahmanyam was working with Insurance Institute of India. I just met him only for a few minutes in 1979. I heard of him before. A man highly respected in many countries. Insurance Institute of India benefited from him a lot. I believe they still hold a prize on his name.

Mr Rajan was in Chennai, when I met him. Later also I met him when he was working as AA of Star health. I never saw this man losing temper. A peace loving person.

Mr RC Rao, was a great human being and contributed a lot to the profession. Mr Pai, Mr Govindan and Mr Rajagopalan, our veterans, remember him a lot.

Mr KP Sarma was a good worker. I must say that he gave his blood to the Institute. He made very useful contributions to the profession. The last one was his mortality investigation Report-2006-08, published by the IAI.

Mr Guhagarkar used to advise us to take care of health just before exams. If necessary, take tonics. If you are healthy, your mind will be healthy and you can write well.

Somehow I miss very young actuaries who died young----Jatley and Rustogi. They used to share lots of fun with me. Pray for their souls to rest in peace.

We have many veterans now. I request them to share their experiences with us in this magazine. Not only we remember great actuarial souls, but also we get encouraged to do good jobs for the profession.

STATE-WISE VARIABILITY IN THE LEVEL OF CONCENTRATION IN INDIAN LIFE INSURANCE INDUSTRY

Introduction

The Indian Life Insurance industry had a sole life insurance company, namely Life Insurance Corporation of India (LIC) prior to its privatization, which took place in 1999. Consequent upon the privatization, the number of private insurers has been on the rise, which has led to the surge in their combined market share. Market concentration is an important characteristics and point of interest in any industry if it is free to private participation, as it is linked to the level of competition amongst the market players.

An extreme case of market structure is monopoly, which has a sole company to operate. This was the case with Life Insurance Industry prior to privatization, as only LIC of India was licensed to sell life insurance products in India. The other extreme case of market structure is known as the "Perfect Competition", wherein there has to be a very large number of companies and entry and/or exit of a particular company do not impact the market in many aspects, such as, price of product, etc. The share of each company needs to be negligible under this case.

In between Monopoly and Perfect Competition, there are stages known as Oligopoly (a very few number of firms) and Monopolistic Competition (large number of firms). The Monopolistic Competition is a stage in between Oligopoly and Perfect Competition. These stages are not disjoint with clear-cut boundaries and rather overlapping. Further, they depend a lot on the type of market. The current stage of competition in the Indian life insurance industry fits into the stage of Monopolistic Competition, as the number of life insurers in India are in the twenties.

The present analysis attempts to study the trend and growth of private insurers and their market shares in various parts of India. It uses select measures of market concentration to analyze the same. There exists a significant variation in the market share of private insurers across the various states and union territories of India.

The article uses data of total life insurance industry for some of the analyses and drops the sole public sector life insurer, LIC, for rest of the analysis so that the competition amongst the private life insurers within the private life insurance industry could be carried out with better clarity.

Literature Review

The studies on market concentration and competition relating to insurance industry are somewhat less as compared to other service sector industries, such as banking, tourism etc. An exhaustive list of measures of concentration can be found in paper of Bikker and Haaf (2001), which enlisted 10 measures and described their computations and uses through numerical illustrations. The paper has also highlighted merits and demerits of these measures.

Several countries have attempted to measure the level of market concentration in the insurance industry. Majority of the studies belong to the developed countries and mostly these pertain to a particular line of business/segment of insurance, such as, Life Insurance, Health Insurance, Property and Casualty (P&C) etc., rather than the total insurance business in the country. There are relatively more studies in the United States than other countries. For example, Joskow (1973) analyzed structure of non-life insurance, Carrol (1993) took worker's compensation insurance, Chidambaran et al (1997) studied property-liability insurance, Bajtelsmit and Bouzouita (1998) considered private passenger automobile industry, etc. All these studies used the data of insurance market of United States.

Amongst the recent years, Deem et al (2007) studied concentration of health insurance in the United States. Tipuric et al (2008) studied market concentration of select countries in Europe and also examined the influence of purchasing power of the population on the development of insurance market. Recently, Njegomir et al (2011) analyzed the concentration of non-life insurance market of the ex-Yugoslavia. The study revealed the existence of strong influence of market concentration and liberalization on the market profitability. Similarly, the study of Skuflic et al (2011) analyzed insurance market concentration in Croatia. The study also attempted to forecast market concentration for Croatian insurance for future years. In the Indian context, a recent study of Sinha et al (2012) analyzed the market share of life insurers and also attempted to forecast the key concentration indicators for different time horizons.

It is expected that there could be many countries, which have not yet analyzed the insurance market concentration in a detailed manner, as is normally done to analyze the insurance penetration and insurance density of the countries. The author feels that the market concentration is also an important indicator in the insurance market of a country, especially if the country is witnessing a transition for various reasons.

Measures of Concentration

Generally, the level of competitiveness in the industry increases with the increase of number of companies. There are many useful indicators, which measure the competitiveness in the industry and have their own characteristics. The present study uses two measures of concentration, viz. the k-concentration ratio (CR_k) and the Herfindahl-Hirschman Index (HHI). These two measures have been used widely by other researchers as well. They preferred these against other measures because of their relative merits. The measures are defined, in the context of insurance business, as below:

Concentration Index

Let the industry has "N" number of companies with their respective Volume of Outputs (say, Premium underwritten), "P_i", i = 1, 2, …, N. Then the Concentration Index of the i^{th} company is defined as:

$$S_i = 100 * P_i / P$$

Where, P is ΣP_i (i = 1 to N), which is the total premium of the industry. In case, there is only one company (monopoly in the market), the Concentration Index takes the value as 100, and in case of very large number of companies (perfect competition), it tends to zero. Thus, it ranges from 0 to 100.

k-Concentration Ratio (CR_k)

The k-Concentration Ratio is the cumulative shares of the biggest k companies in the industry. Therefore, $CR_k = \Sigma S_i$ (i = 1 to k). Similar to Concentration Index, the k-Concentration Ratio ranges from 0 to 100. It can be seen easily that there could be different measures for different k-values ($1 \le k \le N$).

Herfindahl-Hirschman (HH) Index

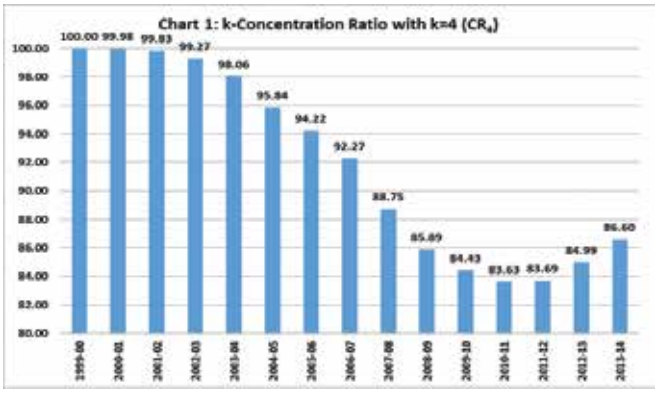
This indicator is calculated as the sum of squares of market shares. Thus, HHI = $\sum S^2_i$ (i = 1 to N).

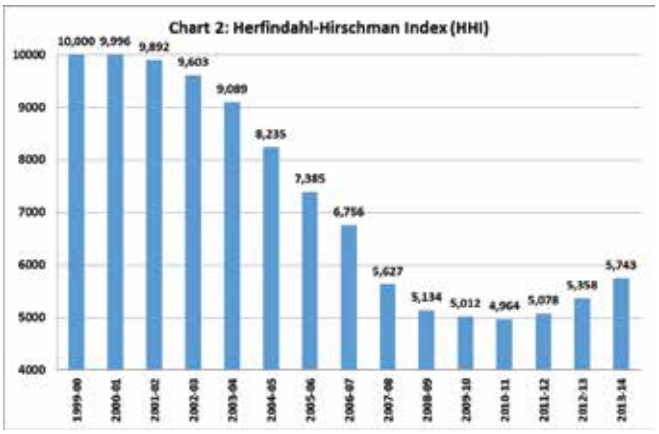
It varies from 0 to 10,000 (or, 0 to 1, if shares are expressed in terms of fraction rather than per cent). The values of 0 and 10,000 represent perfect competition and monopoly respectively. Usually, a value in the range 0-1000 indicates non-concentration in the market, a value within 1000-2000 indicates that there are no adverse effects on competition, and a value of above 2000 is a concern and needs further investigation. HH Index is regarded as one of the most important concentration indicator. In addition, there are other indices for measuring the level of competition in the industry. Some of them are named as, Hall-Tideman Concentration Index, Rosenbluth Index, Comprehensive Concentration Index (CCI), Hanah and Kay Index (HKI) and Gini Coefficient.

Market Concentration – Industry-level

The data used in the study is taken from the Handbook on Indian Insurance Statistics 2013-14 of the Insurance Regulatory and Development Authority of India (IRDAI). As discussed in the previous section, the present study uses two measures namely, k-concentration ratio (with k = 4) and Herfindahl-Hirschman Index (HHI) for the business volumes (premium underwritten) by the life insurers during the years 1999-00 to 2013-14 for the Indian life insurance industry.

The total life insurance premium, which is the sum of first year premium and renewal premium, is taken for this purpose. Chart 1 exhibit the CR_4 for Indian life insurance industry during 1999-00 to 2013-14. From the chart, it may be observed that this indicator of market concentration has declined over time since privatization consistently with a free-fall during 2002-03 to 2010-11. However, it is remarkable to take note of its reversal in the later years. The Chart 2, which exhibits the Herfindahl-Hirschman Index, confirms similar pattern of the life insurance industry. The author regards this reversal to be a bit unanticipated although believes that it may not be long lasting. Further, the early estimates have already hinted of a comeback of private life insurers in FY 2014-15 with a smart regain in their market shares





surging to around 30 per cent (rise by 5 percentage points).

Market Concentration – State-level

Attempt is made to compute these concentration indices for various states and union territories to separately identify the state-wise differentials in the market concentration. For this purpose, the individual first year life insurance premium is taken for the year 2011-12. The group premium is discarded, as it may not be appropriate for locational analysis. Further, the data of 2011-12 is chosen for this to reflect a lower concentration prevailed prior to reversal, which appears to be short-lived. Further, the computation is repeated by removing LIC from the data to study concentration within the private life insurers rather than whole life insurance industry.

Table 1 provides the indices of CR_4 and HHI for various states and union territories for both sets of data (Industry and only Private).

From the table, it can be immediately observed that the indices vary significantly across the states. The CR_4 for the Industry stands at around 80 and 50 in cases of the total life insurance industry and private life insurance industry respectively. In case of private industry, four states/UTs viz. Manipur, Nagaland, Andaman & Nicobar Island and Lakshadweep have a 90^+ value of CR_4, indicating very high concentration. Two states viz. Uttar Pradesh and West Bengal has a smaller CR_4 than that of India, indicating a lower concentration (more competition) than that of the country average.

Table 1: State-wise CR_4 and HHI Indices for Indian Life Insurance Industry and private

State / UT	CR_4 (INCL. LIC)	CR_4 (EXCL. LIC)	HHI (INCL. LIC)	HHI (EXCL. LIC)
Andhra Pradesh	80.77	51.54	4515	1039
Arunachal Pradesh	91.86	78.39	5388	3174
Assam	82.27	53.32	4773	1028
Bihar	86.46	63.43	5162	1276
Chattisgarh	78.94	59.09	3506	1438
Goa	80.55	55.72	3917	1067
Gujarat	80.47	51.37	4471	930
Haryana	73.11	60.75	2029	1248
Himachal Pradesh	88.34	72.00	4982	2012
Jammu & Kashmir	85.39	74.17	3698	2364
Jharkhand	79.01	53.62	4183	970
Karnataka	81.40	51.70	4612	924
Kerala	82.78	59.64	4332	1113
Madhya Pradesh	86.60	57.35	5561	1316
Maharashtra	81.73	52.68	4575	998
Manipur	89.26	90.99	3127	2825
Meghalaya	86.86	69.90	4473	1740
Mizoram	80.44	76.80	2448	1824
Nagaland	96.94	93.04	5589	3280
Orissa	80.02	56.89	3974	1071
Punjab	71.24	54.76	2333	998
Rajasthan	85.14	58.22	5061	1173
Sikkim	82.95	79.86	2916	1731
Tamil Nadu	81.99	52.50	4643	936
Tripura	80.06	60.29	3877	1209
Uttar Pradesh	80.91	48.81	4818	848
UttraKhand	85.88	61.40	5155	1288
West Bengal	82.41	48.86	5166	934
Andaman & Nicobar Is.	98.71	94.80	7191	3043
Chandigarh	86.91	66.73	4959	1882
Dadra & Nagra Haveli	61.32	60.04	1327	1262
Daman & Diu	94.40	89.52	4841	4847
Delhi	75.48	52.07	3372	966
Lakshadweep	98.38	99.23	3045	4341
Puducherry	85.51	68.08	4321	1614
India	**80.33**	**50.38**	**4455**	**873**

The HH Index at the country level stands at 4455 (including LIC) and at 873 (excluding LIC). It is interesting to note that, in case of the industry, there are many states each having more and less HHI values than that of HHI of the industry. However, the same is not equally true in case of Private (viz. Industry minus LIC), which has only one state (Uttar Pradesh), having a lower HHI than that of the industry.

On further inspection of the data, it is noticed that the private insurers are largely concentrated in select states and their presence is almost nil in other parts of India. Accordingly, their spread is localized except for a few large private insurers. More interestingly, some of the private insurers are relatively dominant in specific state(s); while others are dominant in other states. Accordingly, on an aggregate basis, these distinct concentrations get averaged out leading to low level of concentration for the private industry. Accordingly, it is important to examine and measure these joint characteristics of the states and insurers in more detail individually.

Table 2: State-wise Insurance Companies having multiplier of > 2.00

State / UT	Insurance Companies (Multiplier)
Andhra Pradesh	ING Vysya (2.92), Sriram (6.15)
Arunachal Pradesh	Aviva (3.50), IDBI Federal (3.16), SBI Life (3.54)
Assam	DLF Pramerica (2.91), Tata AIG (2.71)
Bihar	Bajaj (3.01), Future Generali (2.34), Sahara (7.72)
Chattisgarh	Bharti Axa (2.03), SBI Life (2.11)
Goa	Edelweiss (2.89), IndiaFirst (3.41)
Gujarat	Edelweiss (4.43), IndiaFirst (3.91), Kotak Mahindra (2.21)
Haryana	Aviva (2.23), Canara HSBC (2.06), DLF Pramerica (2.12), Max Life (2.23)
Himachal Pradesh	DLF Pramerica (3.12), SBI Life (2.63)
Jammu & Kashmir	Metlife (11.99)
Jharkhand	Sahara (2.70), Star Union (4.06)
Karnataka	ING Vysya (2.90)
Kerala	IDBI Federal (5.70)
Madhya Pradesh	Star Union (3.08)
Maharashtra	Edelweiss (2.36)
Manipur	Bajaj (5.50), Max Life (2.66)
Meghalaya	Birla Sunlife (3.86), SBI Life (2.04)
Mizoram	Bajaj (3.72), Reliance (2.30)
Nagaland	Max life (6.02), SBI Life (2.03)
Orissa	None
Punjab	Canara HSBC (2.10), DLF Pramerica (5.78), Edelweiss (2.95)
Rajasthan	IndiaFirst (2.88), Sahara (4.22)
Sikkim	Aegon Religare (3.21), Bajaj (2.24)
Tamil Nadu	ING Vysya (2.05), Shriram (4.32)
Tripura	Aviva (2.69), Bajaj (2.35), DLF Pramerica (5.68), Reliance (2.19), Tata AIA (2.75)
Uttar Pradesh	Future Generali (2.30), Sahara (4.01)
UttraKhand	None
West Bengal	Reliance (2.73), Tata AIA (2.35)
Andaman & Nicobar Is.	Bajaj (3.34), Max Life (2.84), SBI Life (2.79)
Chandigarh	Aegon Religare (5.68), Bharti AXA (2.82), DLF Pramerica (4.36), Edelweiss (4.42), HDFC Standard (2.94)
Delhi	Kotak Mahindra (2.29)
Puducherry	Shriram (5.53)

Now the author proposes a measure for relative market concentration of an insurer through a multiplier, which is defined as:

m_{ij} = market share of j^{th} insurer in i^{th} state / market share of j^{th} insurer in India = $s_{ij} / s_{.j}$

Accordingly, for example, if an insurer XYZ has a market share of 8 per cent in Maharashtra, while its share is 5 per cent in India, the value of multiplier will be 1.60. A multiplier of more than one and less than one would mean that the relative share of the insurer in a particular state is more or less respectively with regard to its share in the industry. Table 2 provides the values of this multiplier, having more than 2.00 in various states and union territories.

Note: Three UTs viz. Dadra & Nagra Haveli, Daman & Diu and Lakshadweep were discarded from this table due to their insignificant figures of Premium. The shares are computed after the exclusions of these 3 UTs.

It may be noted that a high value of multiplier does not necessarily mean dominance (in absolute sense) of an insurer in a particular state, as there may be other dominant insurers even with a low multiplier. The interpretation is in terms of relative dominance, that is, an insurer has higher market share in a particular state as compared to its own overall share in the industry.

After observing the fact that many private insurers are focusing their business in select areas, it becomes important to know whether these characteristics would remain the same over time or would change. It may be generally expected that newly entered private life insurers might concentrate their business in high degree of localized areas, at least initially. As the insurer matures (in terms of number of years of operations) and grows (in terms of its business size), it slowly expands its business in the larger domain. An attempt is made to examine association between this localized characteristic of the insurer with its business size.

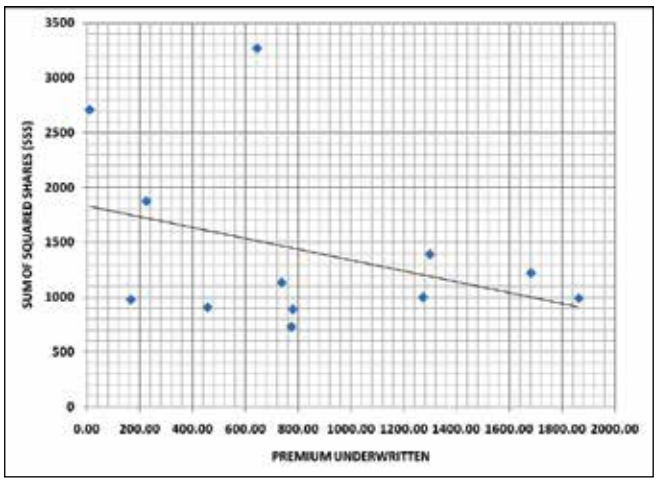
The author proposes a measure, namely the Sum of Squared Shares (SSS) for measuring the distribution of business across the states of an insurer. It may be noted that the SSS is analogous to the Herfindahl-Hirschman Index and its computations are identical. The HHI is used for measuring the market share of insurers in a particular state. The SSS is used for measuring the shares of states of a particular insurer.

A high value of SSS would represent high degree of localized business of an insurer. Accordingly, we may expect negative association between the SSS and Premium Size, as we expect the company to broaden and expand to larger parts of India (reduction in localized business) as its business volume increases.

We provide the scatter diagram of SSS for various insurance companies with their premium underwritten. For this purpose, we take the premium figures as the total life insurance premium, which is the sum of first year premium and renewal premium, as it makes more sense. The scatter plot is provided in Chart 3 and Chart 4 for premium amounts of upto ₹2,000 crore and above ₹2,000 crore.

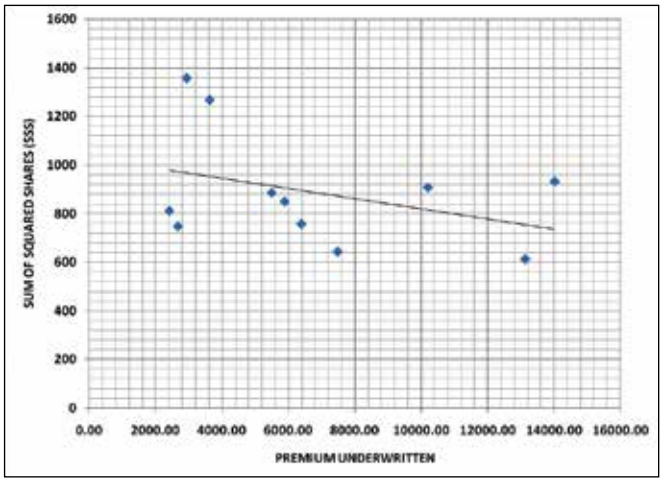
From the charts, it is observed that majority of insurance companies are close to the declining trend line confirming that the SSS declines (localized business reduces or spreading of business increases) with the increase of business size (premium) of the insurance companies. However, there are a few companies, which depart from the trend line (either way). This interprets that there could be existence of other insurer specific factors, such as business strategy, marketing etc., which might be influencing the business expansion process. For example, we observe a higher-than-expected SSS for the company "Shriram Life" given its business size of ₹644 crore (Chart 3). The insurer is heavily concentrated in one state viz. Andhra Pradesh (47.39 per cent).

Chart 3: Scatter Plot of Sum of Squared Shares (SSS) with Premium (P ≤ ₹2,000 crore)



In contrast, we observe a lower-than-expected SSS for the "Bajaj Life" given its level of underwritten premium of ₹7,483 crore (Chart 4).

Chart 4: Scatter Plot of Sum of Squared Shares (SSS) with Premium (P > ₹2,000 crore)



Working back to the market concentration of insurance companies across states, it may be pertinent to know the factors and determinants, which influence the concentration. These could be the locality of the insurer, the geographical spread of the offices of the insurer, geographical distribution of agents, type of products, target group, etc. The present article attempts to correlate the premium underwritten by an insurer to its spread of offices/branches across the states. It is expected that both would be highly (positively) correlated.

A recent study of Sinha et al (2013) carried out a regression analysis to explain the insurance penetration of India in its various states through the explanatory variables, per capita GDP, per capita number of offices and per capita number of agents. The study found all these three variables to be statistically significant in explaining the state-wise insurance penetration in India.

In the present study, the author does not take the per capita number of offices in the states. Rather the share of number of offices in a state to the total number of offices is taken. This is computed for each insurer. A co-variate (O_{ij}, P_{ij}) is defined as below:

O_{ij} = (the number of offices of an insurer "j" in a state "i") / (total number of offices of the insurer "j" in India) *100

Similarly,

P_{ij} = (the premium underwritten by an insurer "j" in a state "i") / (total premium underwritten by the insurer "j" in India) *100

Thus, the pair of values, O_{ij} and P_{ij} provides relative dominance of the spread of offices and business volume respectively of a particular insurer. We drop LIC and consider the data of only private life insurers to study the correlations. Table 3 provides the correlations of (O_{ij}, P_{ij}).

Table 3: Correlation Coefficient of (O_{ij}, P_{ij})

Sr. No.	Insurers	Correlation Coefficient
1.	AEGON	0.925
2.	AVIVA	0.892
3.	BAJAJ ALLIANZ	0.902
4.	BHARTI AXA	0.894
5.	BIRLA SUNLIFE	0.841
6.	CANARA HSBC	0.785
7.	DLF PRAMERICA	0.869
8.	EDELWEISS TOKIO	0.929
9.	FUTURE GENERALI	0.918
10.	HDFC STANDARD	0.773
11.	ICICI PRUDENTIAL	0.687
12.	IDBI FEDERAL	0.764
13.	INDIA FIRST	0.605
14.	ING VYSYA	0.955
15.	KOTAK MAHINDRA	0.853
16.	MAX LIFE	0.867
17.	METLIFE	0.804
18.	RELIANCE	0.729
19.	SAHARA	0.964
20.	SBI LIFE	0.966
21.	SHRIRAM LIFE	0.966
22.	STAR UNION DAI-ICHI	0.705
23.	TATA AIA	0.760
	TOTAL (PRIVATE)	**0.904**

It is again interesting to see that the correlations vary across the insurers. The correlation coefficient is computed as 0.904 for the whole private industry. The same is on the lowest side for the insurance company, ICICI Prudential, with 0.687. The same for SBI Life and Shriram Life is 0.966 each and stands at the highest amongst all companies. A high correlation indicates that the premium underwritten is in line with the number of offices opened by the insurance company in that particular state.

The scatter plot of each of the company is provided in the Annex along with its maximum values of O_{ij} and P_{ij}.

For the private life insurance industry, these maximum values stand at 10.18 per cent and 16.17 per cent respectively. Both of these two pertain to the state "Maharashtra". It may be noted that these are indeed analogous to k-Concentration Ratio (with k=1), viz. CR_1, although these are measured for shares of firms rather than share of area/region. This is simply the share of largest (by number of offices or premium underwritten) state. The state "Maharashtra" is the highest each in its share of number of offices (10.18 per cent) and in its premium underwritten (16.17 per cent).

There are six insurers, viz. Aegon Religare, Aviva Life, Birla Sunlife, Edelweiss Tokio, Max Life and Star Union, which also have their largest share of business (as well as largest spread of offices) in Maharashtra, although the shares vary from insurer to insurer. There are six more insurers, viz. Bajaj Allianz, Canara HSBC, HDFC Standard, ICICI Prudential, Kotak Mahindra and Tata AIA, which have largest share of business in Maharashtra although not largest spread of offices in this state. In contrast, there are four insurers, viz. Bharti Axa, IDBI Federal, Indiafirst and SBI Life, which do not have largest share of business in Maharashtra despite they have largest spread in Maharashtra.

From the scatter plot, some of the other states are identified which have significant share of select insurers either in office spread or premium underwritten or both. These states are Andhra Pradesh, Gujarat, Karnataka, Kerala, Punjab, Uttar Pradesh and West Bengal.

It may be interesting to study the association of market concentration with the geographical distribution of individual agents as well. Author suggests to carry out a multiple linear regression analysis to explain market concentration of life insurers across the states through the agents and office profile of insurance companies. These may provide further insights into the market concentration and competition of Indian life insurance industry.

Conclusions and Discussions

The market concentration of the life insurance industry declined on the path of post-privatized era till 2010-11. The recent years, however, witnessed some reversal of key concentration indicators, which shows continued prominence of LIC. The author, however, believes the market concentration to dip (increase in market competition) in the long-run and accounts for policy change and statutory amendments (such as rise in FDI), which may also facilitate the process.

As per the premium figures of 2011-12, there exist large differentials in the level of market concentration of life insurance business in India across the states and union territories. The article has identified states, which have larger variations and are compared with the India-average. Similarly, it has identified

the private life insurance companies, which are relatively more prominent in particular state with regard to (private life insurance) industry-average. For this, the article has proposed a concept of multiplier to address the comparability.

It is observed that the private life insurers, newly entered in the industry, generally concentrate their business in localized areas, at least initially. As the insurer matures and grows in terms of its business size, it slowly expands its business in the larger domain.

An attempt has been made to find the extent of correlations between the spread of offices and the business volume (premium underwritten). Both are generally found to be highly correlated although the same vary across the insurance companies.

The nature of correlations is exhibited in the scatter plots (provided in the Annex) for respective private life insurance companies. In case of same scale of both the axes (x-axis and y-axis), the points (indicating pair of values for various states and union territories) should lie on a straight line with 45 degree in order to represent perfect (positive) correlation. Even in case of different scales in the x-axis and y-axis, the points should lie on a straight line although at an angle of more or less than 45 degree. The scales in the graphs have been mostly kept unequal to have better visibility and representation of the data points.

Many values lying closer to the origin coupled with a few values far from origin represent concentration of distribution. That is, the insurer has localized business in select states indicating absence of adequate spread of business across different parts of the country.

Further, the scatter plots depicting many data points deviating from the straight line indicates that for the given set of distribution of offices, the corresponding distribution of premium is higher or lower than the average premium per office of the company.

In contrast, a good spread of points closer to the straight line indicates that the insurer has an adequate spread of business across states. This phenomenon is visible mostly in the old and matured insurance companies.

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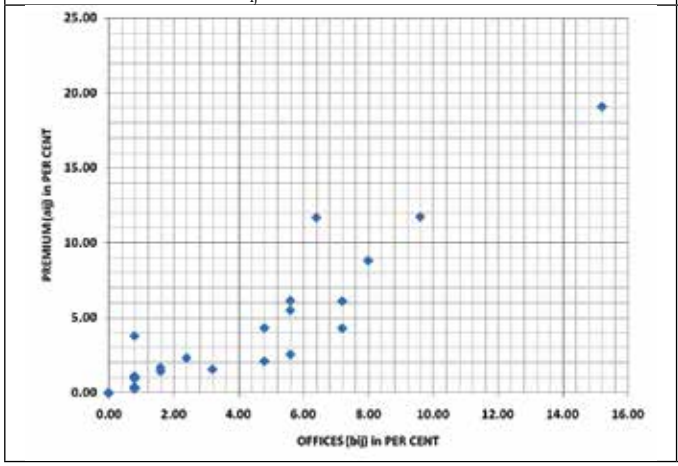
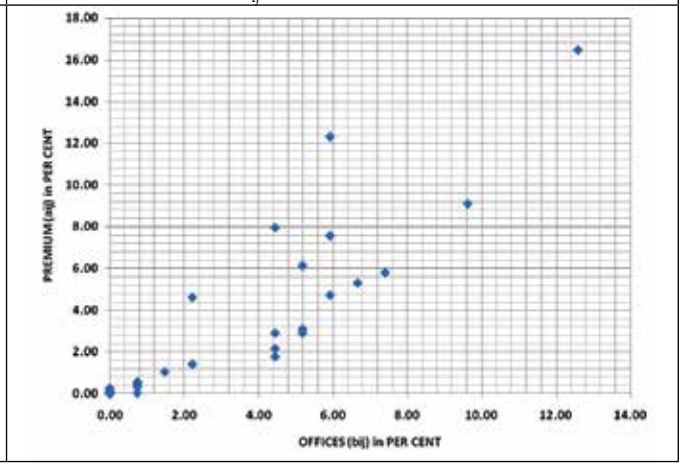
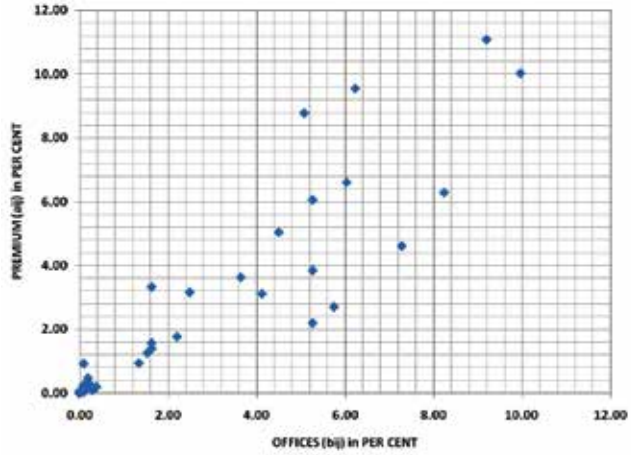
ANNEX

AEGON RELIGARE Max (O_{ij}) = 15.20 - Maharashtra Max (P_{ij}) = 19.07 - Maharashtra	**AVIVA** Max (O_{ij}) = 12.59 - Maharashtra Max (P_{ij}) = 16.47 - Maharashtra
	

BAJAJ ALLIANZ

Max (O_{ij}) = 9.96 - Uttar Pradesh

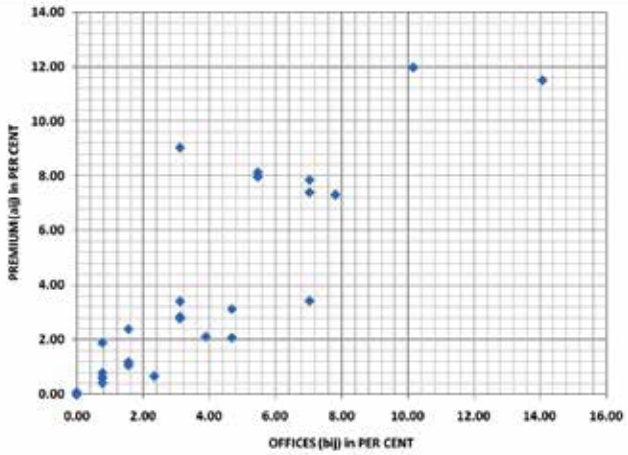
Max (P_{ij}) = 11.10 - Maharashtra



BHARTI AXA

Max (O_{ij}) = 14.06 - Maharashtra

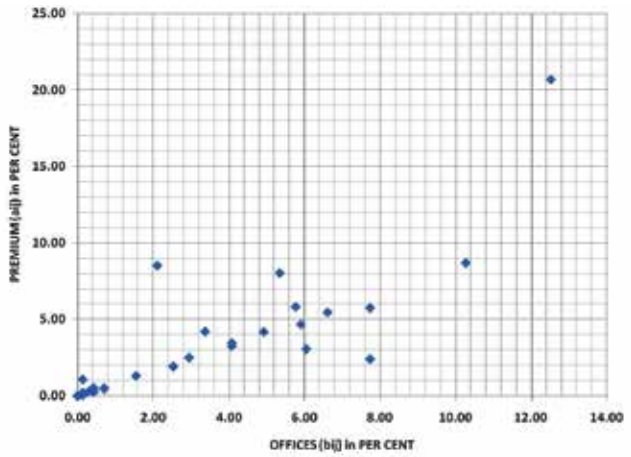
Max (P_{ij}) = 11.97 – Uttar Pradesh



BIRLA SUNLIFE

Max (O_{ij}) = 12.52 - Maharashtra

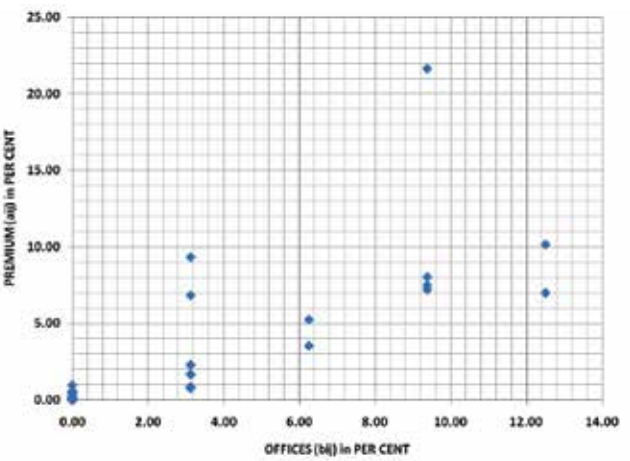
Max (P_{ij}) = 20.68 - Maharashtra



CANARA HSBC

Max (O_{ij}) = 12.50 - Karnataka

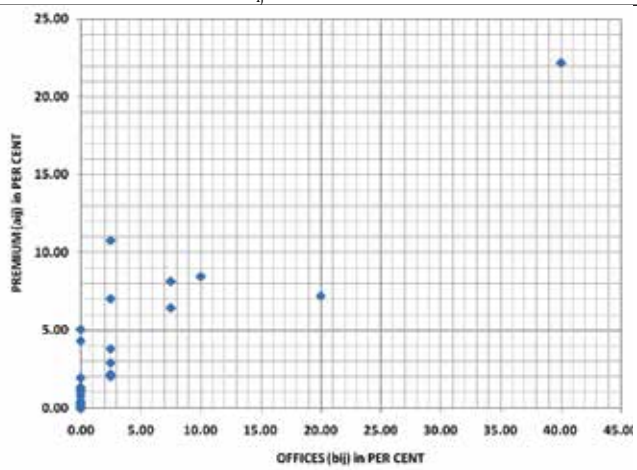
Max (P_{ij}) = 21.66 - Maharashtra



DLF PRAMERICA

Max (O_{ij}) = 40.00 - Punjab

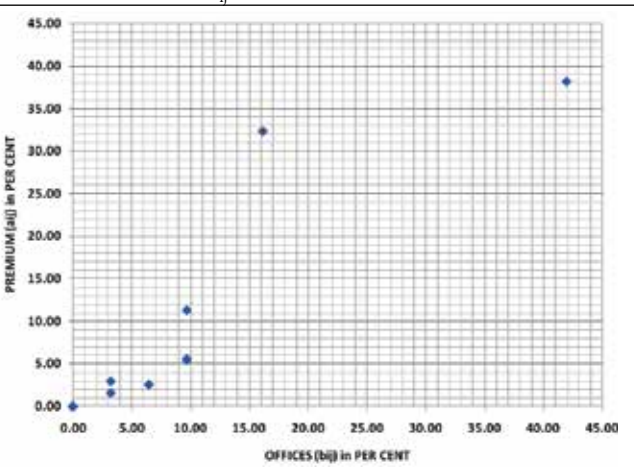
Max (P_{ij}) = 22.18 - Punjab



EDELWEISS TOKIO

Max (O_{ij}) = 41.94 - Maharashtra

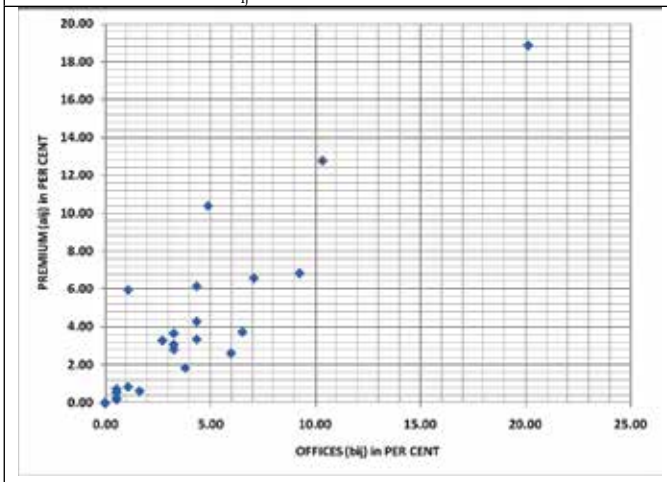
Max (P_{ij}) = 38.16 - Maharashtra



FUTURE GENERALI

Max (O_{ij}) = 20.11 – Uttar Pradesh

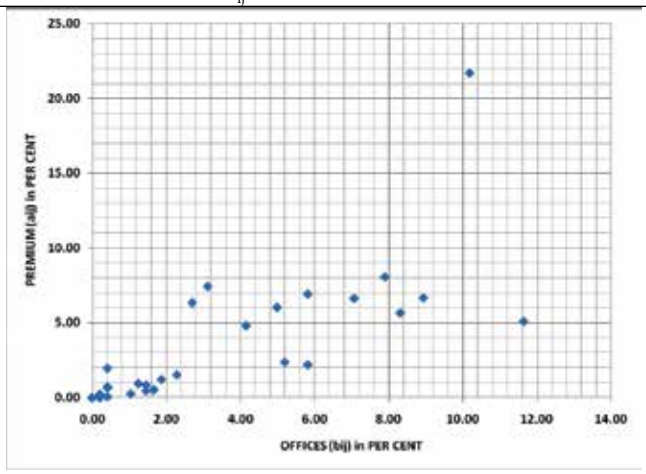
Max (P_{ij}) = 18.86 – Uttar Pradesh



HDFC STANDARD

Max (O_{ij}) = 11.64 - Kerala

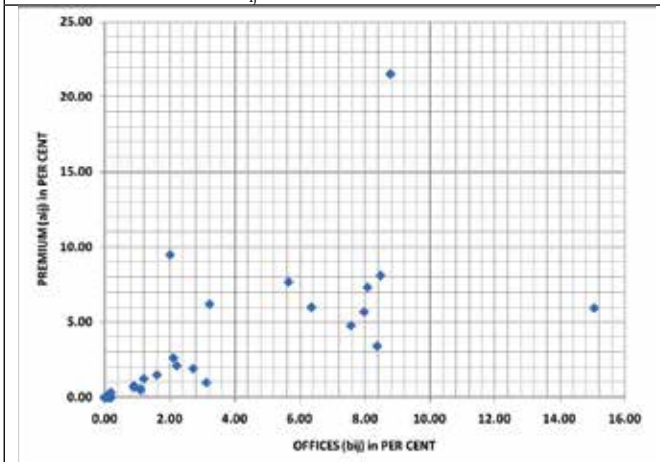
Max (P_{ij}) = 21.68 - Maharashtra



ICICI PRUDENTIAL

Max (O_{ij}) = 15.05 – Andhra Pradesh

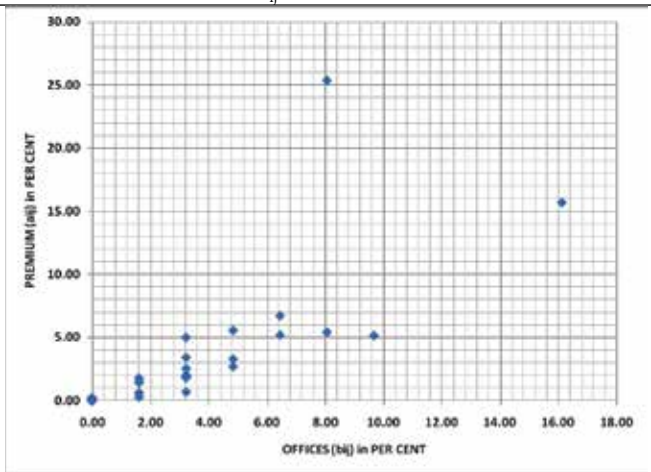
Max (P_{ij}) = 21.53 - Maharashtra



IDBI FEDERAL

Max (O_{ij}) = 16.13 - Maharashtra

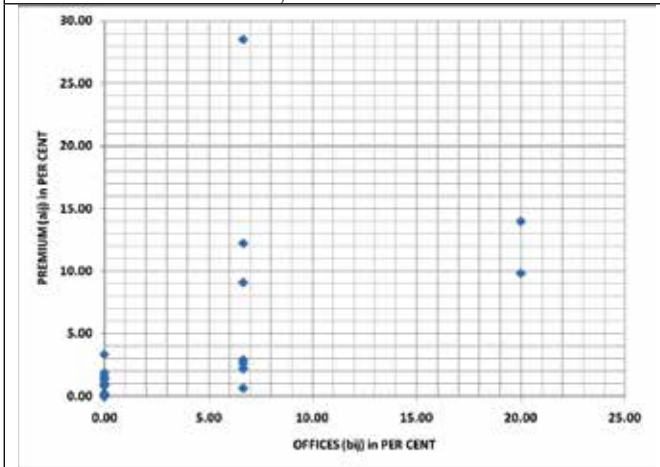
Max (P_{ij}) = 25.36 - Kerala



INDIA FIRST

Max (Oij) = 20.00 - Maharashtra

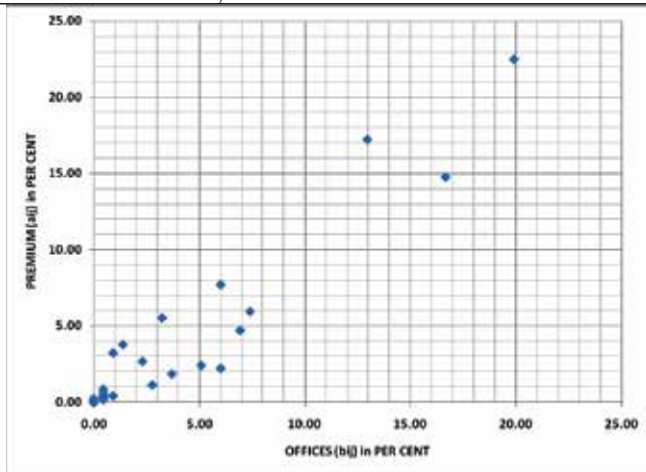
Max (P_{ij}) = 28.49 - Gujarat



ING VYSYA

Max (O_{ij}) = 19.91 – Andhra Pradesh

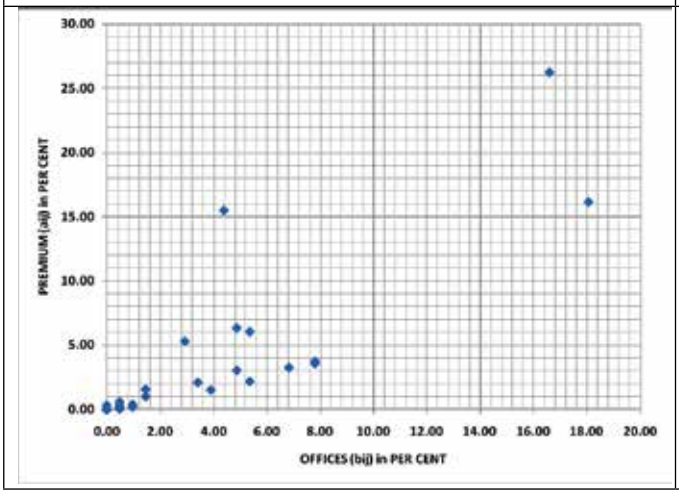
Max (P_{ij}) = 22.49 – Andhra Pradesh



KOTAK MAHINDRA

Max (O_{ij}) = 18.05 - Gujarat

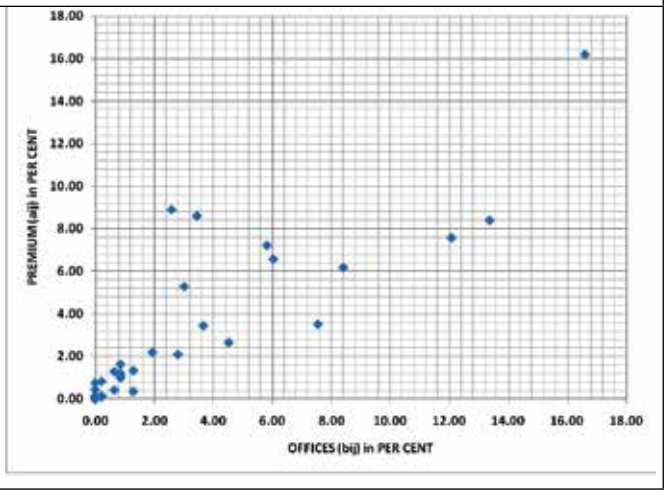
Max (P_{ij}) = 26.23 - Maharashtra



MAX LIFE

Max (O_{ij}) = 16.59 - Maharashtra

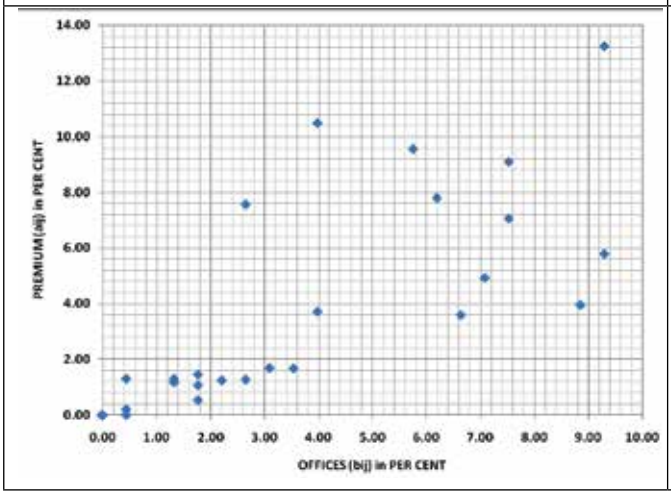
Max (P_{ij}) = 16.19 - Maharashtra



MET LIFE

Max (O_{ij}) = 9.29 – Uttar Pradesh

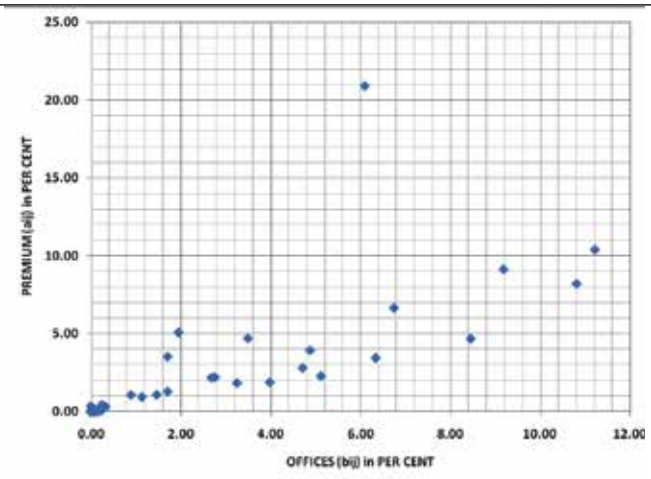
Max (P_{ij}) = 13.26 – Uttar Pradesh



RELIANCE

Max (O_{ij}) = 11.22 – Uttar Pradesh

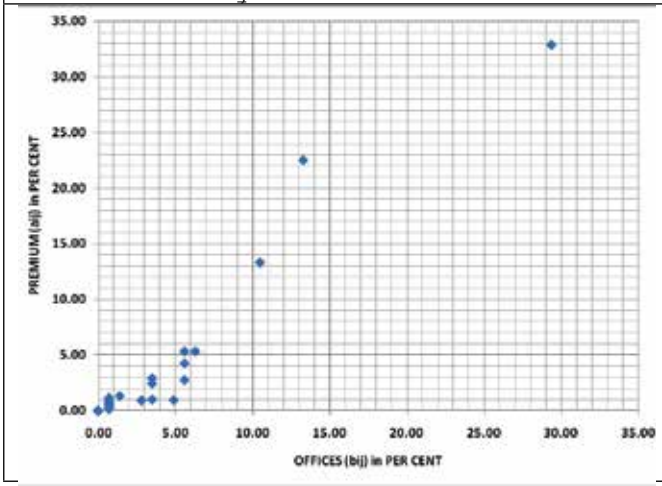
Max (P_{ij}) = 20.89 – West Bengal



SAHARA

Max (O_{ij}) = 29.37 – Uttar Pradesh

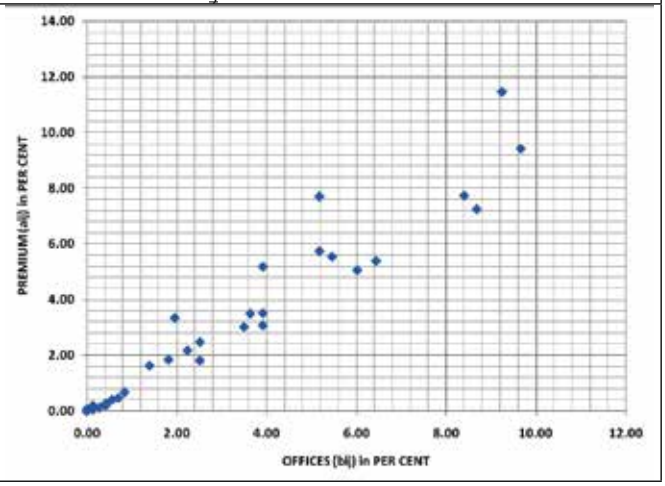
Max (P_{ij}) = 32.91 – Uttar Pradesh



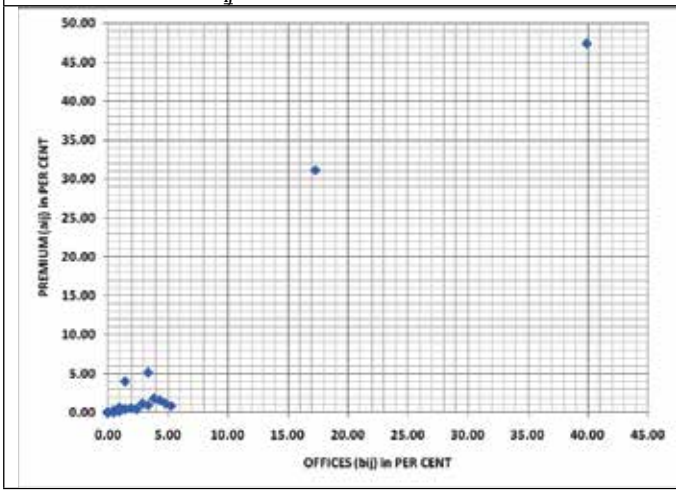
SBI LIFE

Max (O_{ij}) = 9.66 - Maharashtra

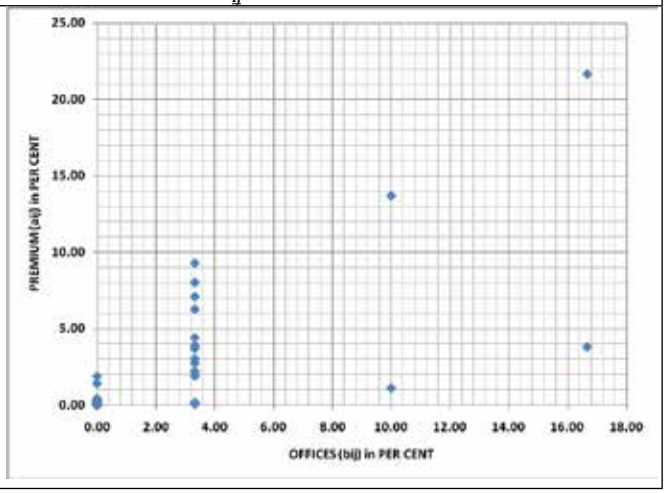
Max (P_{ij}) = 11.46 – Andhra Pradesh



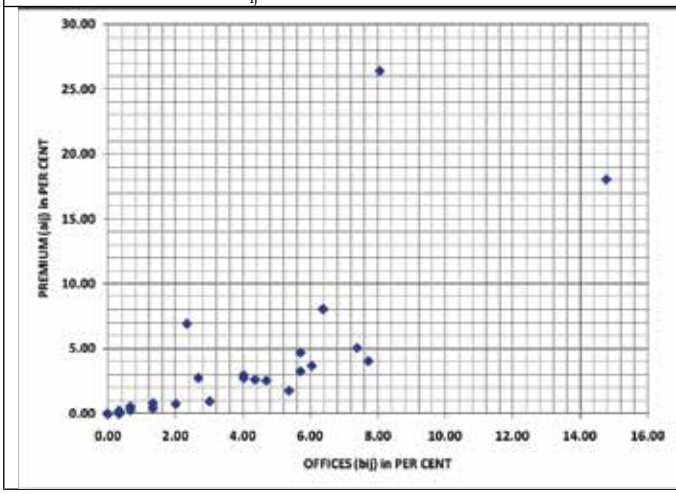
SHRIRAM
Max (O_{ij}) = 39.90 – Andhra Pradesh
Max (P_{ij}) = 47.39 – Andhra Pradesh



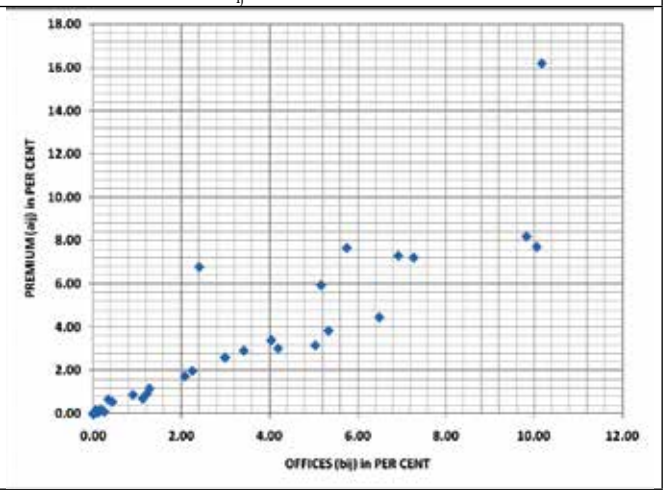
STAR UNION
Max (O_{ij}) = 16.67 - Maharashtra
Max (P_{ij}) = 21.66 - Maharashtra



TATA AIA
Max (O_{ij}) = 14.77 – West Bengal
Max (P_{ij}) = 26.38 - Maharashtra



TOTAL (PRIVATE)
Max (O_{ij}) = 10.18 - Maharashtra
Max (P_{ij}) = 16.17 - Maharashtra



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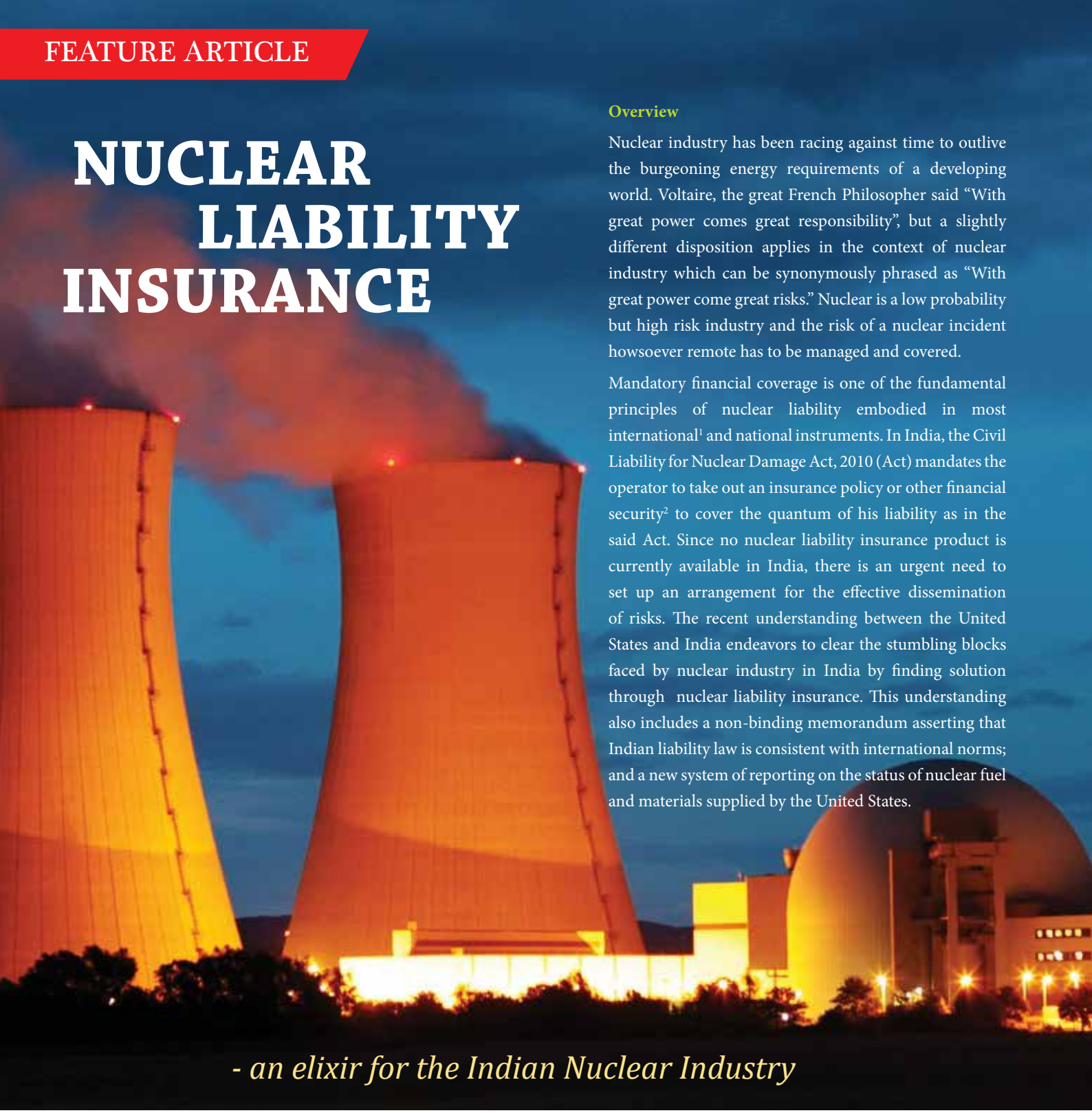
NUCLEAR LIABILITY INSURANCE

- an elixir for the Indian Nuclear Industry



Overview

Nuclear industry has been racing against time to outlive the burgeoning energy requirements of a developing world. Voltaire, the great French Philosopher said "With great power comes great responsibility", but a slightly different disposition applies in the context of nuclear industry which can be synonymously phrased as "With great power come great risks." Nuclear is a low probability but high risk industry and the risk of a nuclear incident howsoever remote has to be managed and covered.

Mandatory financial coverage is one of the fundamental principles of nuclear liability embodied in most international[1] and national instruments. In India, the Civil Liability for Nuclear Damage Act, 2010 (Act) mandates the operator to take out an insurance policy or other financial security[2] to cover the quantum of his liability as in the said Act. Since no nuclear liability insurance product is currently available in India, there is an urgent need to set up an arrangement for the effective dissemination of risks. The recent understanding between the United States and India endeavors to clear the stumbling blocks faced by nuclear industry in India by finding solution through nuclear liability insurance. This understanding also includes a non-binding memorandum asserting that Indian liability law is consistent with international norms; and a new system of reporting on the status of nuclear fuel and materials supplied by the United States.

Insurance of Nuclear Installations -Specificities and Apprehensions

The development of nuclear power in the 1950s presented insurers with entirely new risks and problems. Experience over six decades has however, shown the fear of catastrophe to be exaggerated, though the local impact of a severe nuclear accident was shown at Fukushima in 2011 to be considerable, even with no direct human casualties from the nuclear accident (contrasting with 19,000 deaths from the tsunami which caused it).[3] Such a nuclear incident is capable of crippling generations and this has been confirmed in the Chernobyl incident which killed 30 people directly, as well as damaging approximately $7 billion of property. A study published in 2005 estimates that there will eventually be up

1 See IAEA Handbook on Nuclear Law vol. 1, p. 99
2 Section 8
3 Fukushima Daiichi Accident Study (Status as of April 2012) SANDIA report by Randall Gauntt, Donald Kalinich, Jeff Cardoni, Jesse Phillips, Andrew Goldmann, Susan Pickering, Matthew Francis, Kevin Robb, Larry Ott, Dean Wang, Curtis Smith, Shawn St.Germain, David Schwieder, Cherie Phelan *See: http://energy.sandia.gov/wp/wp-content/gallery/uploads/Fukushima_SAND2012-6173.pdf*

to 4,000 additional cancer deaths related to the accident among those exposed to significant radiation levels. Radioactive fallout from the accident was concentrated in areas of Belarus, Ukraine and Russia. Approximately 350,000 people were resettled away from these areas soon after the accident.[4] Prior to that, the Three Mile Island accident in 1979 was taken as being indicative. In the backdrop of these catastrophic incidents and inability to gauge an underwriting cycle, the insurers were reluctant to anticipate nuclear liability. This has had an immense impact on the mindset of insurers who do not wish to be entangled in the complexities of settling the countless claims a nuclear accident may cause. Some of these apprehensions are genuine since no significant and reliable data is indeed available for a conclusive risk probability analysis and most of the calculations have to rely on theoretical assumptions, the damage caused could be undeniably extensive, which itself creates the need for compulsory third party insurance schemes for nuclear operators. Given these facts, if nuclear power is to grow in India to meet energy requirements of its teeming millions, the risk has to be socialized with the government stepping in.

By reason of their nature and size, large nuclear risks have been, from the outset, beyond the resources of any one national market - let alone an individual insurer - to provide cover. Insurance industry, the world over realized long ago that traditional insurance mechanisms were not suited to covering such risks and responded to these difficulties by the formation of market-wide national Pools and by the widespread adoption of exclusion clauses in their non-Pool portfolios as a mechanism to harness the greatest possible capacity commitment in support of the nuclear industry. There are now 26 such market Pools, yet even with these it is still not possible to provide full insurance cover for all nuclear operators' exposure to risk.

Six decades have gone by since the initiation of world's early nuclear insurance pools viz. Nuclear Energy Property Insurance Association (NEPIA), the Nuclear Energy Liability Insurance Association (NELIA) and the Mutual Atomic Energy Reinsurance Pool (MAERP) (dealing with both property and liability) in 1956 which gathered over 300 companies and reached an underwriting capacity in excess of $125 million[5], in response to pressure from both governments and the nuclear industry for the abovementioned reasons that would proved to be disincentives.

Nuclear Insurance Pools

A Pool is essentially a mechanism whereby a number of insurers agree to appoint a common agent to underwrite jointly a particular risk or class of business, commonly employed where the risks in question are few in number, or requires a capacity beyond the means of individual members even if arranged on a traditional co-insurance basis, or which presents some particularly hazardous aspect which would render acceptance by conventional methods difficult, if not impossible. Even nuclear power plant operators the world over, take out their insurance for nuclear first or third party liability directly with a nuclear insurance pool, without having to establish a contractual link with each and every of the pool´s members. The pools are composed of insurance and reinsurance companies which en masse offer re-insurance capacity based on the proportions made available for nuclear risks by the cedants of the pools.

Thus, by the formation of net-line Pools, the insurance industries of the world have succeeded in accumulating the maximum available capacity for this class of business. Thus, the Pooling System operates to the benefit of the nuclear industry and ultimately society as a whole.[6]

Indian scenario

The CLND Act, 2010 makes operators liable for any nuclear accident and determines the liability cap for them at INR 1500 crores. However, unlike the existing international instruments the Indian legislation does not exempt suppliers of the liability of their product. NPCIL is currently the sole operator of nuclear installations in India. Section 8 supplemented by Rule 3[7] of the Act mandates financial security for the

operator before starting the operation of its nuclear installation. Seeking other forms of financial security such as a bank guarantee which in fact, has been taken by NPCIL at the moment may be cumbersome and may not only block the capital of the operator but does not actually cover the risk as on invocation of guarantee in the event of a nuclear incident the amount paid by the bank gets converted into a debt recoverable with interest and cost from the operator. Therefore, the operator may prefer to go in for insurance of his plant which will simply involve some recurring revenue expenditure towards premium.

Indian Nuclear Insurance Pool

The efficiency of nuclear insurance pool arrangements while recognized all over the world was well appreciated in the recent US-India understanding which talks

4 The Chernobyl Catastrophe - Consequences on Human Health, a Study by The Greenpeace (2006)
See: http://www.greenpeace.to/publications/chernobyl_health_report.pdf

5 Richard D. Mc Clure, A Review of Nuclear Energy Insurance (paper presented at the November Meeting of 1968 of the Casualty Actuarial Society), www.casact.org/pubs/proceed/proceed68/68255.pdf.

of insurance not only for the operator but even the suppliers. At the moment, a national nuclear insurance pool is currently being finalized by the General Insurance Corporation of India (GIC Re) and four public sector undertakings engaged in the general insurance business in India. These companies have collectively created an insurance pool by putting together a capacity of Rs.750 crores, and reinsurance for the same is being sought. The balance capacity would be generated by way of floating catastrophe bonds to solicit domestic as well as international investment, the incentive being constant returns in the form of coupons. This is based on the mechanism of funding primary financial products, such as lending or insurance, through capital markets. Now, it remains to be seen as to how the Indian nuclear insurance pool unfolds in the coming time and addresses the concerns of various stake holders. The modalities and the premia are being finalized, and the United States has committed to work with India to share information and best practices on the formation of this insurance pool.[8]

Insurance for Suppliers

A rationalized approach as regards the supplier's liability is followed worldwide. Channeling liability to the plant operator is comparatively rational because insuring a single plant is simpler and therefore more economical than separately insuring the plant's hundreds of suppliers. India has taken a different road in this context; Section 17 of the Act, extends the liability to the suppliers of nuclear equipment or material with latent or patent defect or substandard services by conferring upon the operator a right of recourse, the extent of their liability is collateral to that of the operator or their respective contract values, whichever is less.[9] Further, though the Act does not mandate insurance for suppliers, they may be interested in indemnification and obtaining insurance cover. As of now, no such cover has been designed for the suppliers anywhere in the world. This opens a whole new arena of actuarial analysis since the liability of suppliers is substantially different in nature than that of the operator and thus the risks associated may not be similar.

Meanwhile, GIC:Re is working on one such policy customized for the suppliers. By issuance of an insurance policy to the suppliers, GIC:Re would indirectly waive its right of subrogation obtained through the operator against them. The suppliers may then recoup the cost for obtaining such indemnification by charging the operator more for their services. For this purpose, the suppliers can be classified into three sections viz. Tier I suppliers who have greater contract values at or above INR 1500 crore, these include large companies like the Westinghouse Electric Company and Areva. Further, Tier II suppliers consist of those with relatively large contract values within INR 1500 crores, and Tier III suppliers that have small contract values.

Conclusion

The risks presented by the civil use of nuclear power are categorized as low-frequency, high-cost events. On the one hand, they demand a deployment of capacity by the insurance market that is greater than in any other sphere of industrial activity, but on the other, the risks themselves are few in number and present an unbalanced portfolio with scant statistical data. However, with the development of specialized mechanisms, the quantum of individual exposure can be reduced by way of their dissemination over a large financial base. Work is ongoing in India to create such arrangement and it remains to be seen as to how these endeavors unravel in the coming time to address the concerns of the industry.

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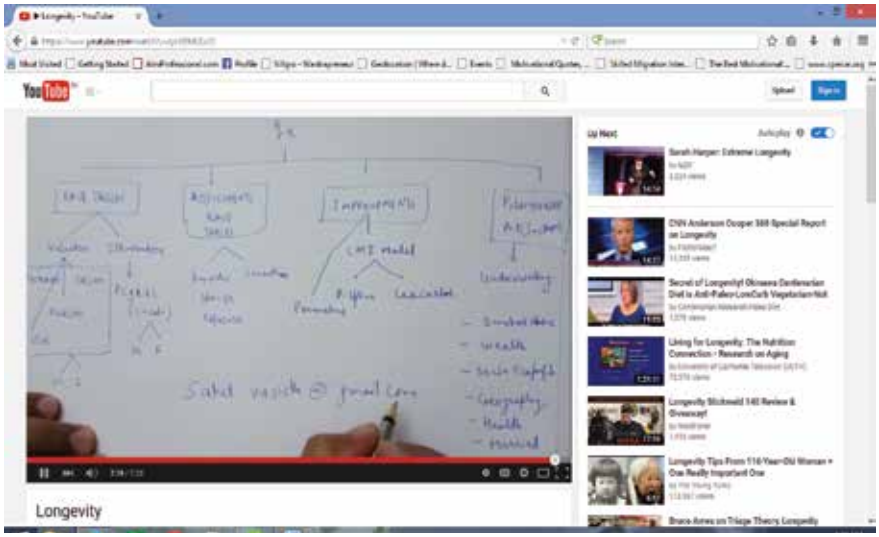
6 Statement of Joint Secretary (D&ISA) Transcript of Media Briefing by Foreign Secretary on President Obama's visit to India (January 25, 2015)
7 http://www.mea.gov.in/media-briefings.htm?dtl/24732
8 Rule 24

EQUITY RELEASE – VALUATION PART 2: LONGEVITY ASSUMPTION

Equity Release valuation depends upon choice of valuation model, appropriate assumptions and customer data. This article is second in the series of articles on actuarial valuation of Equity Release. This article covers a discussion on longevity assumptions used in Equity Release Valuation model.

Equity release is a financial contract that allows elderly people to benefit from the value of their house without having to move out, by borrowing against home or selling all or part for a regular cash flow stream or lumpsum. Equity release is a means of retaining use of house (or other object which has capital value), along with obtaining a lump sum or a steady stream of cash inflow, from the value of such house. The equity release provider has to be repaid later with interest, usually when policyholder dies or goes in for long term care. At that time house is sold. Equity release is also known as reverse mortgage or home equity conversion loan. Equity release is particularly useful for seniors who do not intend or are not able to leave a large estate for their heirs when they die. Such elderly persons must be of a minimum age (which is country-specific, For US 62, UK 55) and live in their own home to sign equity release contract.



Longevity risk: The risk to which a pension fund or life insurance company could be exposed as a result of higher-than-expected payout ratios. Longevity risk exists due to the increasing life expectancy trends among policy holders and pensioners, and can result in payout levels that are higher than what a company or fund originally accounts for. The types of plans exposed to the greatest levels of longevity risk are defined-benefit pension plans and annuities, which guarantee lifetime benefits for policy or plan holders.

Death of the policyholder or, in the case of joint policyholders, the last to die, is the major reason of repayment of the Equity Release loans. In the case of home reversions, death of the policy holder results in the reversion of the relevant share of the property to the provider.

(Source: Investopedia.com)

Policyholders of Equity Release belong to the similar age-band as policyholders of immediate annuities. It is therefore, reasonable to expect similarities with annuitant longevity risk for Equity Release policyholders. Like other annuity products, it is generally reasonable to keep select period of two years for equity release contracts also. Determination of the select period should include the fact that many companies refuse to sell equity release to impaired lives. This reduces the number of deaths in the early years so an adjustment to this effect should be made in the available qx tables.

Provider normally price Equity Release contracts assuming a certain profile of loan repayments (or property reversions). Reversions and fixed-repayment Equity Release expose the provider to the risk of people living too long. Where the policyholder lives longer than expected and hence exit his/her home later than expected, the provider will receive his repayments later than expected. This will adversely impact profitability. Also this will increase costs relating to refinancing.

Life time mortgages, interest only loans or shared appreciation mortgage expose the provider to (i) policyholder dying too soon and, (ii) depending on Loan to property value (LTV), to people living longer than expected. If redemption proceeds are received earlier than expected, there can be a yield shortfall on the funds received compared to the rate of rollup

on the expected profile of repayments. There is also likely to be a shortfall in redemption costs recovered from the policyholder. On the other hand, excess longevity may result in refinancing costs and will effectively increase the cost of the NNEG to the provider. However, there is a beneficial impact of the extra interest-rate margin earned on the mortgages for a longer period.

Mortality factor (q_x) to be applied on projected cash flows to compute expected repayments is made of following four components:

1. Base tables
2. Adjustment to base tables
3. Future mortality improvement
4. Policyholder specific underwriting adjustment

Base tables: There are no mortality tables specifically for Equity Release policyholders in the UK. Although there are a number of tables for annuitants in the 92/00-series mortality tables, for life-office pensioners (the PM/FA and PM/FL tables), for immediate annuitants (the IM/FA and IM/FL tables) and for retirement annuitants (the RM/FV tables). However, they are not directly suitable (without adjustment) for the Equity Release population.

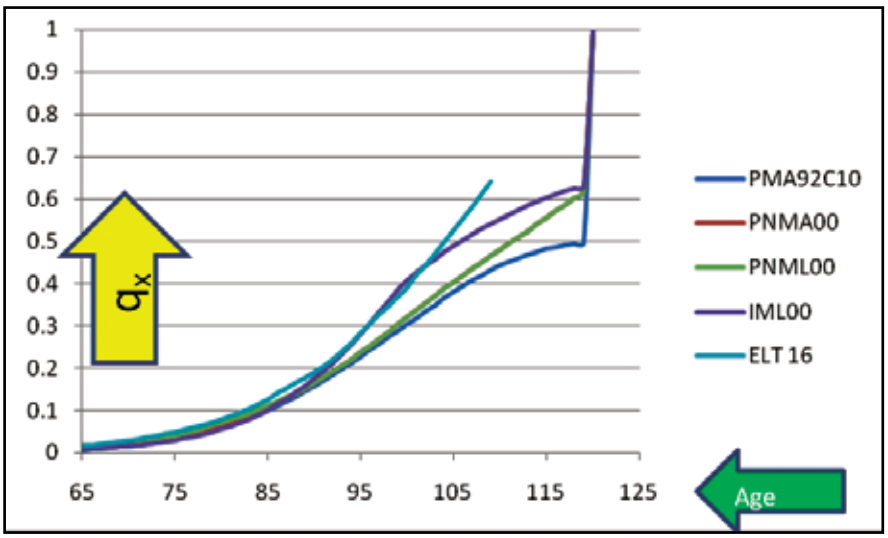
Some of the Equity Release experts in the UK feel that it is good to use PNXA00 (U2007) as the base table, principally because of the good fit between the socio-economic profile of lives buying equity release contracts and those buying pension annuities. This table is derived from significantly more data than other annuity tables. Therefore, provides a relatively credible starting point. There is inherent 'level' risk in the base q_x of incorrect current mortality factor measurement.

For valuation purpose, following tables can be used after appropriate adjustments:

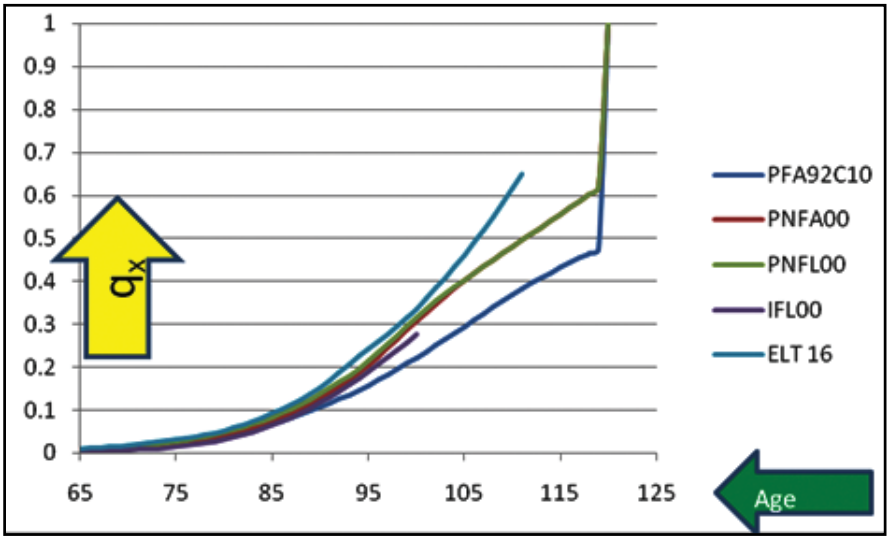
Males / Females	PXA92C10	Pensioners, Amount weighted, 2010
	PNXA00	Pensioners, Normal, Amount weighted, 2000
	PNXL00	Pensioners, Normal, Lives weighted, 2000
	IXL00	Immediate annuitant Lives weighted, 2000
	ELT 16	English Life Table 16

These are available at:
http://www.actuaries.org.uk/research-and-resources/pages/00-series-mortality-tables-assured-lives-annuitants-and-pensioners
ELT 16 is available at: http://www.ons.gov.uk/
Here is how these tables look:

For males:



For females:



It can be seen that out of all the tables, ELT 16 provides high q_x rates almost across all ages. Hence, shorter life spans. PXA92C10 provides least q_x rates. Hence, higher life spans.

For benefit illustrations: The FSA's Conduct of Business sourcebook for Mortgages (MCOB) came into force on 31 October 2004. This sets out, in Chapter 9, the rules relating to Equity Release schemes, including benefit illustrations. MCOB can be found here: http://fshandbook.info/FS/html/handbook/MCOB

MCOB 9.4.10 R requires that in estimating the term of a lifetime mortgage or an open-ended installment reversion plan, a firm must:

a. use the following mortality table: PMA92(C=2010) and PFA92(C=2010) for males and females respectively, to be derived from the Continuous Mortality Investigation Report 17, published by the Institute of Actuaries and the Faculty of Actuaries in 1999 and

b. for the purposes of the illustration, where the table does not result in a life expectancy expressed in whole years, the term should be rounded up

to the next whole year. For example, if the result is between fifteen and sixteen years, an estimated term of sixteen years should be used in the illustration.

c. Where the term estimated using the mortality table set out above is less than fifteen years, the firm should use a term of fifteen years in preparing the illustration. Where the illustration is issued to two or more customers who intend to borrow jointly, or who own the property jointly, the term estimated should be based on the longest life expectancy.

d. These tables can be found at: http://www.actuaries.org.uk/research-and-resources/documents/mortality-rates-and-complete-expectations-life-pfa92c2010-and-pma92

Base tables are of 1×n matrix format with age at entry arranged vertically and base mortality rate provided for each such age.

Adjustments to Base tables: Base tables taken from the Continuous Mortality Investigation (CMI) website may not be directly relevant for the providers at times given (i) geographical spread of the policyholders of the provider, (ii) unsmoothed nature of CMI tables etc. Also because of the following factors an adjustment may be required on the base tables:

1. Base tables may pertain to very old date. For example, using 00 series of q_x tables for valuing contracts in 2014 will require adjustment for the time elapsed from 2000 till 2014.
2. There is a risk of anti-selection for availability of Equity Release for impaired lives
3. There may be volatility risk arising from lesser than expected deaths in the future
4. Experience risk arising due to misestimating of base mortality tables from actual by expected (A/E) analysis
5. Risk that adjustment to base mortality for Equity Release for impaired lives may be incorrect

Future mortality improvement: Life expectancy has increased at a tremendous rate in the UK, from 1975 to 2010. This factor in mortality rate determination takes care of risks arising from cures of diseases that might not be observable in the historical data. Also following reasons contribute to life expectancy improvement in the UK:

- Medical advances are occurring at a faster rate than the rate in past. It appears logical to obtain expert opinion of medical practitioners also on likely future mortality improvement trends.
- Further reductions in key risk factors – e.g. smoking, blood pressure & cholesterol levels
- Increasing focus on healthy diets

Cohort effect: In the UK, men and women born in the period 1925-45 (born around World War II) have experienced more rapid increase in the life expectancy than generations born either before, or after, this period. This is primarily due to the healthy diet provided during the initial/childhood years

At high levels of mortality, gradual advances in medical science may not have a major impact on increasing life expectancy. For example, at older ages, policyholders may suffer from multiple causes of ill-health, so medical treatment for one of those causes still leaves them vulnerable to other causes of ill health. Therefore, it may still require significant time and resources before the medical knowledge and technology is available to improve life expectancy at higher levels of mortality. During the period of high mortality levels, there will be very less or no improvement in life expectancy. As medical advances occur, it takes an increasing amount of new medical advances to further reduce mortality rates i.e. improve life expectancy.

The CMI has discontinued production of standard set of mortality projections. It has now instead provided two stochastic models to project future mortality improvements, P-Spline (penalized spline model) and Lee-Carter.

Let us look at these models one by one:

P-spline: This is a method of optimizing the smooth 'surface' to fit a two dimensional set of past mortality rates depending on age and time. This model is flexible on the past data provided. This model does not impose any particular structure on past patterns of mortality improvements. This model was proposed by Eilers & Marx in 1996. This model imposes penalties on differences between adjacent coefficients i.e. roughness penalty. This model uses penalized likelihood function with a smoothing parameter

which balances fit and smoothness.

P-spline model tends to give more weight to the most recent mortality improvement trends and produces stochastic projections of mortality improvements. To understand the required level of adjustment in the base q_x rate, it is important to understand the key drivers of mortality improvements in the affected age groups. It may be reasonable to assume that the sub-groups of the population which make up Equity Release population and pension annuitants are sufficiently close to adopt the same mortality improvement factors. Given the significant uncertainty around future mortality improvements it appears logical that providers offering no negative equity guarantees should consider providing capital for these guarantees using stochastic projections of future mortality improvements and house prices.

A prototype model was published for consultation in June 2009, alongside two CMI working papers — WP38 provided an introduction to the model while WP39 provided additional research and analysis. The prototype model could be operated at two distinct levels of complexity, reflecting the different needs of users:

1. The 'Advanced' level which contains a large set of parameters, giving users considerable flexibility to modify the projections generated
2. The 'Core' level, where default values are applied to many of the parameters, allowing the user to concentrate on just two inputs:
    - The long-term rate of mortality improvement
    - A constant addition to rates of mortality improvement.

Lee Carter Model: This model was proposed in 1992 in the US. The standard Lee-Carter approach constructs a 'mortality index' from the underlying data and models age-specific mortality rates as a function of this index.

For any given age and time, the age-specific (log) mortality rate is given as:

$$\ln (m(x),t) = \alpha(x) + \beta(x).\kappa(t) + \varepsilon(x)$$

Where:

$\alpha(x)$ is age function which is constant.

$\beta(x)$ is also age function. This measure its sensitivity to changes in the overall mortality index over the period analyzed.

$\kappa(t)$ is time function [mostly modeled using an ARIMA(0,1) time series]. This is mortality index.

ε denotes normally and independently distributed errors

Future mortality rates are then derived by projecting the mortality index k forward in time.

Criticism of this model:

- This model is rigid in terms of its structure
- Another drawback of the standard Lee-Carter approach is that the estimated coefficients remain constant within the projection period. As a result, ages which have experienced relatively high mortality improvements in the past and hence have high beta estimates will have relatively high projected future improvements. Likewise, ages which have experienced lower improvements in the past (e.g. ages greater than 80) will have low projected improvements. If mortality improvements for older ages are set to accelerate, this approach will underestimate life expectancy and hence will undervalue annuities and will impact Equity Release cash flow profile also.
- Basic form of this model has no flexibility to accommodate the 'cohort' trends evident in the UK mortality data

In order to overcome this limitation, a time varying coefficient approach can be used. This will require examining the trends in the alpha and beta coefficients for different age brackets starting from say 50 onwards. And then for projecting forward the mortality index k, the alpha and beta coefficients can be extrapolated in a way that is consistent with previous trends in these.

More discussion on the Lee Carter can be found in this paper: http://www.theactuary.com/archive/old-articles/part-6/longevity-3A-mortality-improvement/

Forecasting mortality improvements depends upon: (i) Choice of model, (ii) Method used for forecasting, (iii) Parameter uncertainty and (iv) Stochastic uncertainty

Future mortality improvement tables are of n × m matrix format with increasing age at entry arranged vertically and calendar year of entry arranged horizontally. For each intersection of age at entry and calendar year there is an improvement percentage populated to be applied on base mortality.

Latest version of the improvement model available is CMI_2014 along with CMI working paper 74 which was published in November 2014. This available at: http://www.actuaries.org.uk/research-and-resources/pages/continuous-mortality-investigation-mortality-projections

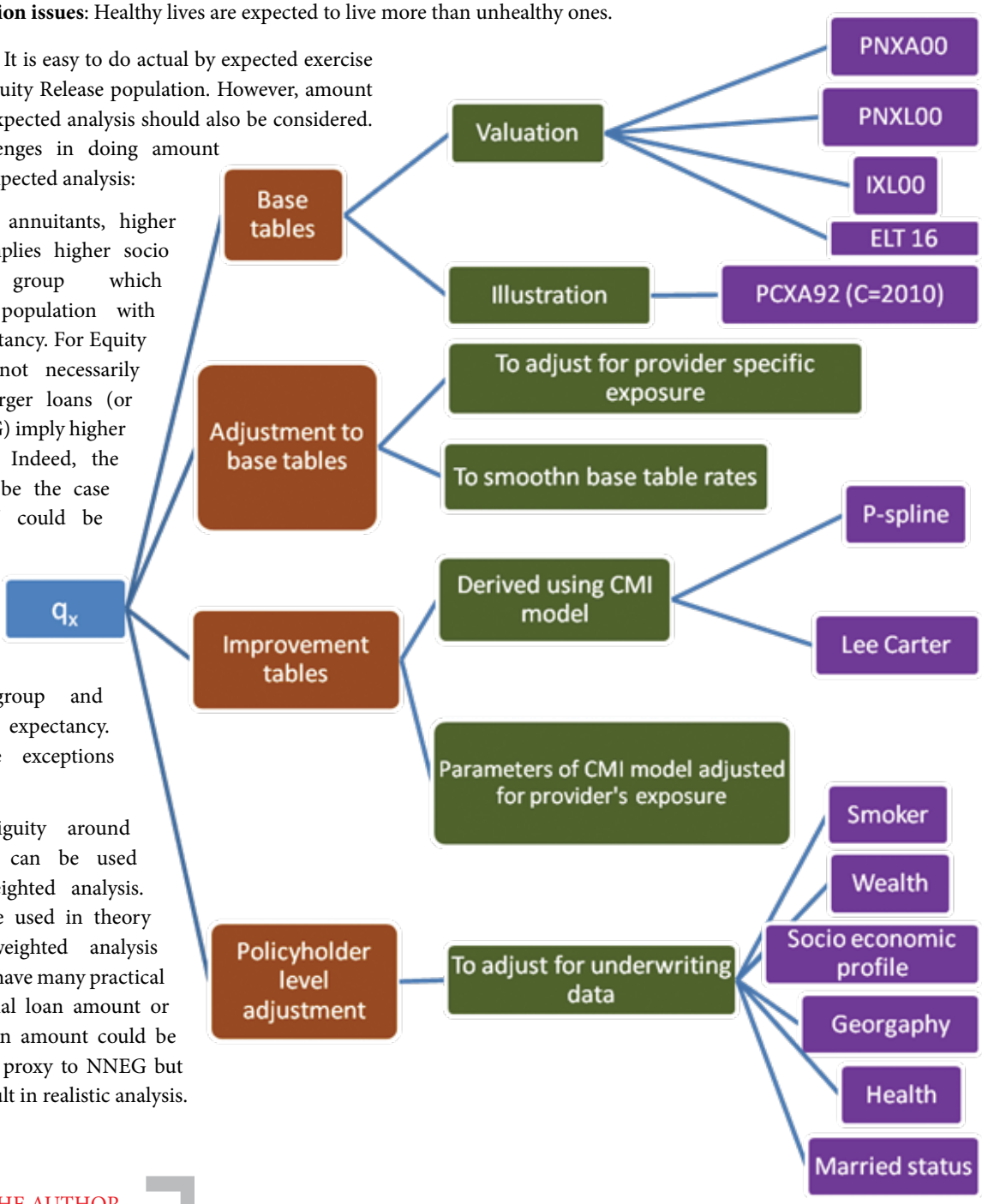
Policyholder specific underwriting adjustment: There is a strong and pronounced link between the socio – economic rating factors and mortality. The longevity actuary needs to consider this when determining policyholder specific underwriting adjustment in the q_x. There should be a reduction in the q_x rates for contracts sold to wealthy lives with low prevalence of smoking. Policyholder specific factors which influence life expectancy (other than age and sex) are:

- **Smoker status**: people who do not smoke generally have higher life expectancy
- **Wealth of the policyholder**: This is measured by household income, salary, property value, pension amount etc. Generally, higher wealth implies access to medical facilities and hence higher life expectancy.
- **Socio-economic profile**: This can be obtained by segmenting databases based on the markets to which they belong. Policyholder in better socio-economic profile has higher life expectancy than the one who is not in the same bracket
- **Geography**: This includes factors such as region, local authority and post codes. Areas with lesser pollution (air and water) have positive impact on the life expectancy of the policyholder

- **Married status**: There may be statistical differences in life expectancy due to the fact that the person is married or not
- **Health / selection issues**: Healthy lives are expected to live more than unhealthy ones.

Experience analysis: It is easy to do actual by expected exercise lives weighted for Equity Release population. However, amount weighted actual by expected analysis should also be considered. Here are the challenges in doing amount weighted actual by expected analysis:

1. In the case of annuitants, higher annuity size implies higher socio demographic group which normally has population with higher life expectancy. For Equity Release, it is not necessarily obvious that larger loans (or with large NNEG) imply higher life expectancy. Indeed, the opposite could be the case as higher LTV could be lent to those in greatest financial need which imply lower socio-demographic group and hence lesser life expectancy. There may be exceptions though.
2. There is ambiguity around which variable can be used for amount weighted analysis. NNEG could be used in theory for amount weighted analysis though this will have many practical constraints. Initial loan amount or accumulated loan amount could be used as a broad proxy to NNEG but this may not result in realistic analysis.



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Next part of this series will focus on probability of going into Long term care, prepayment probability (i.e. lapses) and probability of future drawdown of further loans.

Dear Diary,

It's that time of my life when I have to truly start acting like an adult. My 18th birthday was supposed to make me an adult but all it did was make me legally eligible for a variety of official paperwork. Instead of using my father's money through his bank account, I could now use his money through my own bank account. Apart from that, I have been more or less the same person, managing to make my way through education and unutilized gym memberships.

I have been studying actuarial science for three years now, which is another way of saying that I have been studying it my whole adult life. I will be graduating in a month or two but this particular subject will be with me for the rest of my life, initially in the form of the pending exams and then in the form of my career. My college education is nearing its end and it's time to join an actuarial firm and begin grooming my professional skills while hoping to regularly pass the remaining exams. If only life was easy enough to walk into a firm of my choice and have them opening their arms and welcoming me to join them.

Like in any other profession, an actuarial student is also supposed to prove his worth to be employed. I have to prove how I can be an asset to a company which specializes in dealing with liabilities. In order to do so I had to first prepare a CV which is a grown-up version of those "About myself" essays I wrote as a kid. After that, I made an account on numerous job search engines and uploaded this CV on each of them. It was time consuming at first and it soon became easy since I had to answer the same questions on almost every website. They are free to use but some websites also provide paid special benefits like prioritizing my CV if any recruiter asks for applications. I didn't opt for them because I think such services hardly make a difference. After that, I started actually searching for relevant job openings and that's when I realized how difficult getting a job can be. I always thought passing the exams would be enough for a job but each job profile I read made me understand the importance of experience which I had been neglecting till now. I know that as an entry-level actuary I should have no experience but what troubles me is that almost every company wants someone with at least 1 year of experience. There is hardly any job for inexperienced individuals, irrespective of the number of papers cleared. I have applied for a few jobs which require 0 to 2 or 0 to 3 years of experience but I wonder why they would choose me if there is someone experienced applying for the same job.

I have cleared 4 exams so far and before I started applying, I was worried as I thought that maybe I was a paper short of being eligible for a job. After having explored the internet for 2 weeks I am still worried but what worries me is not the number of papers but my lack of experience. There is rarely any job which requires 0 experience and more than 3 papers. If there is any that requires more than 3 papers than it would most probably also be requiring at least 1 year experience. Hence, my 4 papers are more than sufficient to bag me an entry-level job. The area of concern now is my lack of experience. All companies seem to value experience but very few companies have vacancy to provide experience to people like me who don't have my experience at all. Therefore, these few vacancies are flooded with applications by inexperienced persons who have all cleared the required number of papers. As a result, only a few of them end up being employed while the others hunt for other such rare vacancies to try their luck. I have also applied for such entry-level openings and I know I would be lucky to be even called for an interview.

The worst part of such job hunts is the time after having applied. Only I know how many times I have hoped for an interview call whenever my phone rings. It is brutal, let me tell you that. Being just a book, you wouldn't understand its brutality anyway. Every few hours I refresh my webpage to check out the latest job openings and every few hours I am again disappointed to know that another company wants someone with experience. The key to all this is patience. It must be. If the key is anything else, only God can save the lock from me.

In spite of everything, I am expecting some calls very soon. I believe that the next time I write in you I would be writing about my experience as a newly-employed entry-level actuary. Optimistically, by the end of this month I would have fooled a company into thinking that I can be a great employee. Fingers Crossed.

PS If any recruiter is reading this then please know that I am kidding about fooling a company. I can totally be a great employee. My email id is mentioned in the 'About the Author' box. You know what to do. ;)

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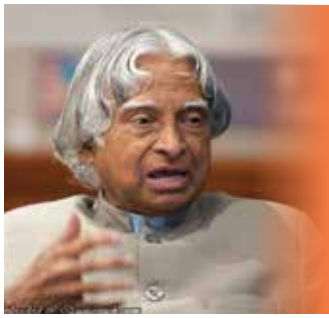


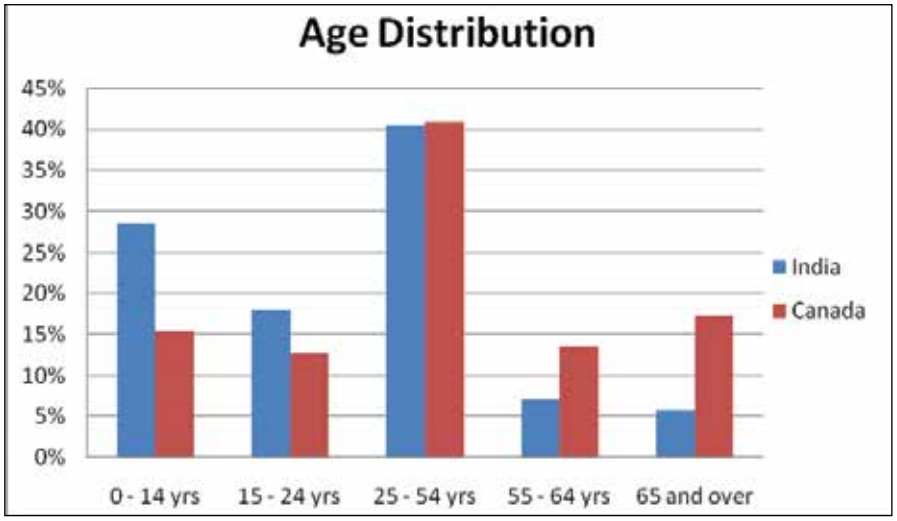
We should not give up and
We should not allow the
problem to defeat us.

- Dr. Abdul Kalam

CANADA

Greetings from Canada!

In this article, I wanted to contrast the different demographics between India and Canada, and how this Influences the products offered by insurance companies in Canada.



Source: https://www.cia.gov/library/publications/the-world-factbook/fields/2010.html

India is a relatively young country with a median age of 27 and about 13% of the population is 55 years or older. Contrast this to Canada where the median age is 42 and about 31% of the population is 55 years or older. A contributing factor to the older age profile in Canada is the baby boom, which was a spike in birth rates following World War II. This cohort will now be entering retirement over the next 20 years.

As the demographics shift, the product needs for this cohort also change. Early in a person's lifecycle the focus is more on protection and savings. In the later years, turning those savings into lifetime incomes becomes more important.

With the changing demographics companies are looking fill this product need with more choices on how to provide lifetime income. The traditional way to provide a lifetime income stream is through a payout annuity. However, interest rates in Canada are at historical lows with the long term rate on government bonds at about 2%. This makes payout annuities relatively expensive and customers are looking for alternative methods to provide life time income. A product many companies are now offering is a Variable Annuity with a Guaranteed Minimum Withdrawal Benefit. Under this product customers can choose their investments based on their risk profile. Their account value will grow with new contributions, fluctuate with investment performance, and be reduced by withdrawals. At a predefined age they can start making withdrawals from their account. A fixed withdrawal amount is guaranteed, and even if the account value is eventually depleted, the fixed withdrawal is guaranteed for life. Some products add other product features such as the guaranteed withdrawal amount is allowed to increase based on good investment performance.

There are many risks associated with this type of product, and companies have developed complex hedging strategies to mitigate this risk.

ABOUT THE AUTHOR

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is an Actuary at Sun Life Financial in Toronto, Canada. He has 20 years of experience in pricing, product development and financial reporting spanning Canada and India.

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VOLUNTEERING OPPORTUNITIES

IAI invites its fellow members and qualified actuaries of IFoA, UK and IAA, Australia to join in its Volunteering Opportunities Initiative. Through this platform, members will be able to share ideas, gain a broader perspective and experience of work outside their own specialist area, through networking with peers, gain CPD hours and be able to give something back to the profession. We invite members who respect the IAI values and what it stands for and wish to take the profession to newer heights of success through their willingness to share their knowledge and/or skills by working in partnership with peers/colleagues.
If you are interested in applying, please visit our website for more details: www.actuariesindia.org

MANY HAPPY RETURNS OF THE DAY

the Actuary India wishes many more years of healthy life to the fellow members whose Birthday fall in **JUNE 2015**

MR. DIONYS EMIL BOEKE
MR. R. KANNAN
MR. P. A. BALASUBRAMANIAN
MR. LIYAQUAT KHAN
MR. RICHARD WALTER LEISER-BANKS
MR. K. SUBRAHMANYAM

[Birthday greetings are made to veteran actuaries who are 60 and over.]

Submit your article atlibrary@actuariesindia.org

We invite articles from the members and non members with subject area being issues related to actuarial field, developments in the field and other related topics which are beneficial for the students of the institute.

The font size of the article ought to be 9.5. Also request you **to mark one or two sentences that represents gist of the article.** We will place it as **'break-out' box** as it will improve readability. Also it will be great help if you can suggest some **pictures that can be used with the article, just to make it attractive.** Articles should be original and not previously published. All the articles published in the magazine are guided by **EDITORIAL POLICY of the Institute.** The guidelines for submitting the articles are available at **http://actuariesindia.org.in/subMenu.aspx?id=106&val=submit_article**

We regret to say that Puzzle column will not be published for next 2 months.

SUDOKU

SUDOKU No. 33 for the month of June 2015

MEDIUM SUDOKU

7			1			6		
3			5	2		7		
1			4			9		3
	9			6			7	
	2			1			4	
	8			7			3	
9		5			8			7
		6		5	9			1
		4			1			2

HOW TO PLAY

Fill in the grid so that every horizontal row, every vertical column and every 3x3 box contains the digits 1-9, without repeating the numbers in the same row, column or box.

You can't change the digits already given in the grid.

- Sudoku Puzzle by Vinod Kumar

Solution of Sudoku Puzzle No.32 published in the Month of May 2015

SOLUTION

7	6	4	2	9	8	1	3	5
9	8	2	1	3	5	6	4	7
1	3	5	6	4	7	8	2	9
3	1	7	5	2	9	4	6	8
5	9	6	4	8	3	7	1	2
4	2	8	7	1	6	9	5	3
8	4	9	3	6	2	5	7	1
2	5	1	8	7	4	3	9	6
6	7	3	9	5	1	2	8	4

UPCOMING EVENTS

3rd Seminar on Current Issues in General Insurance.

Date: 3rd July, 2015
Venue: Hotel Sea Princess, Mumbai.

The seminar would focus on issues such as Regulator's perspective on Industry challenges, opportunities, etc, burning cost for commercial line related products, significance of reserving in effective management of a General Insurance Company, IIB - Journey of data analytics so far and road ahead, behavioral finance and its relevance in GI Pricing.

Who Should Attend?

Senior team members from Claims, Underwriting, Finance and Actuarial functions of General Insurance companies, General Insurance Brokers and Consulting Firms.

Speakers:

Mr. Rajesh Dalmia, President, IAI
Ms. Pournima Gupte, Member (Actuary), IRDA
Mr. Bhargav Dasgupta, CEO, ICICI Lombard
Mr. Mayur Ankolekar, Consulting Actuary, Ankolekar & Co.
Mr. Hiten Kothari, Actuary & Vice President, Almondz Reinsurance Brokers Pvt. Ltd.
Mr. R. Raghavan, CEO, IIB

General Points:

- **Participation Fees** : ₹5000/-(+ 14% Service Tax)
- **CPD Credit for IAI members** : 6 hours, as per APS 9 (ver.2)
- **Registration** : Ends on 26th June, 2015

Accommodation details at subsidized rate is available at http://actuariesindia.org/subMenuaspx?id=255&val=Accomadation_Details

6th Leadership Development Program on Public Speaking

Date: 7th August, 2015 Venue: The Club, Mumbai.

Background:

A full day Communication Skills Training program covering key elements of Voice & Speech, Presentation Skills, & Public Speaking. The learning objectives will be achieved in the form of interactive discussions, as well as practical activities and case studies. This highly interactive program offers participants individualized assessment and group feedback sessions.

Overview of the contents proposed is as below:

I Voice Culture & Speaking Skills - Enhance your voice quality through articulation and modulation Exercises for Clarity in communication:

II Presentation Skills & Public Speaking - Learn how to address with confidence and influence with effective speaking skills

Who should attend?

Only members of Institute of Actuaries of India less than 45 years of age.

General matters:

- **Participation Fees :** ₹ 5000/ (+14% Service Tax) (Includes Lunch & Course ware)
- **Registration Start :** From 10th June, 2015 & Close Date: 15th July, 2015
- **Capacity** : Limited to 20, admission will be on first-come-first served basis subject to receipt of payment. This is a non residential program.

Register at : http://www.actuariesindia.org/SeminarRegistration.aspx
Contact : Ms. Quintus Mendonca at quintus@actuariesindia.org for any assistance.

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