

Lapsation and its impact on Indian Life Insurance Industry (2002-07)

Occasional Paper: 1 / 2008

R. Kannan
K.P. Sarma
A.V. Rao
S.K. Sarma



Insurance Regulatory and Development Authority

November 2008

Lapsation and its impact on Indian Life Insurance Industry (2002-07)

Occasional Paper: 1 / 2008

R. Kannan
K.P. Sarma
A.V. Rao
S.K. Sarma



Insurance Regulatory and Development Authority

November 2008

जे. हरि नारायण
अध्यक्ष
J. Hari Narayan
Chairman



बीमा विनियामक और विकास प्राधिकरण
**INSURANCE REGULATORY AND
DEVELOPMENT AUTHORITY**

Foreword

The Insurance Regulatory and Development Authority (IRDA) recognizes that research has to be undertaken periodically on relevant topics in order that a Regulatory framework could evolve which would enable the growth of the insurance industry in a manner which enhances the welfare and prosperity of policyholders, the interests of shareholders and the economic stability of the country. The IRDA has, therefore, decided to undertake and promote such research and to publish the research findings for wider dissemination and discussion amongst the industry, insurance specialists and the general public.

In furtherance of the above effort, I am glad to write this Foreword to the first such publication being brought out by the IRDA. This paper is on the important topic of Lapsation in the Life Insurance Industry in India.

We in the IRDA hope that this publication would found to be of value and interest to the insurers and to the others concerned and involved in the insurance industry in India. The IRDA is conscious, that while continuing research is essential, quite often research throws-up issues and approaches to problem resolution which are quite different from what might have been assumed prior to the research being conducted. It is for this reason that the IRDA has adopted a policy to promote a coordinated and participatory approach to any research endeavour.

I would take this opportunity to congratulate Sri R. Kannan, Member(Actuary), IRDA and his team who have undertaken this study. I would also encourage readers of this monograph to write to the IRDA their views and comments on this occasional paper and to feel free to suggest topics to be studied and results published in the occasional papers to come.

(J. Hari Narayan)

Date : 19th November, 2008
Place : Hyderabad

INDEX

CHAPTER	TITLE	PAGE
I	Introduction	10
II	Lapse Rate-A brief outline	14
III	Trends observed in lapse rate for the industry over the last five years	17
IV	Analysis with Single factor data	37
V	Analysis with Two-factor data	50
VI	Conclusions	67
VII	Recommendations for future study	83

Bibliography	PAGE 88
--------------	---------

ANNEXURE	PAGE
1	89
2	90
3	91
4	92
5	93
6	96
7	101
8	105

Executive Summary

As estimation/study of lapse rate is useful in many ways both for the regulator and for the insurance companies, a study was undertaken to analyse lapses in the life insurance industry in India during 2002-03 to 2006-07 for *individual life policies*. It was decided to collect the data from all the life insurance companies with respect some factors/combinations of factors, affecting lapse rates. This is a preliminary study aiming at estimation of lapse rates and ranking the factors which affect the lapse rates.

Estimation / study of lapse rates is useful for i) pricing the insurance products ii) valuation of insurance liabilities, iii) comparison of experience with other countries iv) bench marking industry lapse rate v) as back ground information in product development vi) identification of changing needs of the insured public and vii) identifying the factors influencing the lapse rates and hence the changes required in various pricing parameters including marketing strategies.

Over the five years of investigation period, industry lapse rate by number of policies increased from 5.62% (2002-03) to 7.8% (2004-05) and decreased to 6.64% (2006-07). However, lapse rate by premium increased from 4.40% to 6.95%, slowly increasing year by year except for a small decrease in 2006-07.

The following are major findings of the study:

The lapse rates for the non-linked products and linked products over the last three years were as follows:

Lapse rate:

Duration elapsed in years	Non-linked			Linked		
	2004-05	2005-06	2006-07	2004-05	2005-06	2006-07
0-1	22.31%	18.95%	6.10%	24.19%	41.06%	13.43%
1-2	12.12%	12.96%	2.50%	9.43%	17.62%	18.10%
2-3	4.51%	5.94%	2.18%	8.73%	6.10%	8.78%
3-4	3.50%	4.74%	5.55%	2.23%	2.50%	3.94%
4-5	3.26%	3.97%	4.42%	6.07%	2.18%	2.08%

- Lapse rate for seven companies out of sixteen exceeded the industry average (simple arithmetic mean) of 18% (lapse rate by number) and 11.9% (lapse rate by premium amount). However, majority of the companies exceeded the industry average rate (weighted average with weights being premium exposed to risk) by a considerable margin.
- Assuming that lapse rates across various companies follow a normal distribution with mean lapse rate of 18.1% and a standard deviation of 7.5%, four companies could be considered to have lapse rate in the average range (17.21% to 19.82%), seven companies can be considered to have lighter lapse rate (ranging from 6.93%

to 14.66%) than the average range and five companies to have higher lapse rate (23.07% to 35.51%).

- Age at entry, mode of premium payment, duration elapsed since policy inception, policy type and type of underwriting are found to be the most significant factors affecting the lapse rates.
- Lapse rate with respect to age at entry showed a decreasing trend from age group 18-22 to around 60 years and lapse rate tended to increase from the range below 18 to age group 18-22.
- Lapse rate (by number of policies) with respect to mode of premium payment tended to be higher with the frequency of premium payment and lower for monthly and salary deduction modes.
- Lapse rates are observed to be decreasing with duration elapsed since inception.
- It was observed that the trends in lapse rate with respect to both number and premiums were almost similar to each other.
- With-profit policies showed higher rates of lapse when compared to their non-profit counter parts for endowment and whole life policies.
- Term assurance products showed the highest rate of lapse with respect to both number and premium lapsed (28.27% by number and 18.95% by premium).
- Whole life products showed higher lapse rate than endowment products for with profit policies and converse is observed for non-profit policies.
- Pension policies were observed to show the least lapse rates among the all categories.
- Unit linked contracts had lapse rate as 18.09% by number and 10.01% by premium. These were higher than for traditional plans.
- Lapse rate with respect to number in Unit linked products was observed to have increased from 17.80% (2004-05) to 26.09% (2005-06) and decreased to 14.34% (2006-07) while premium lapse rate continued to increase from 4.89% (2004-05) to 11.35% (2006-07).
- Lapse rate with respect to number in traditional products was observed to have decreased from 7.69% in 2004-05 to 6.59% 2006-07 and premium lapse rate decreased from 6.45% to 5.63% in the same period.
- Lapse rates for non-medical policies are observed to be higher than for medical policies.

Analysis of causes affecting lapse rates indicated the following:

- Revival campaigns seemed to have significant effect in reduction of the levels of lapse rate.
- Low commission in the first year contributes to the lower level of lapses in the following years as the omission is well distributed over the initial period.
- The special incentives (as per product approval conditions) given to intermediaries had significant effect in reducing the levels of lapse.
- Sending copies of notices to intermediaries helped in bring down lapse rates considerably.
- As all companies had reported sending premium notices in advance, no differences could be analysed on this factor, although this practice is positioned strongly since mid 2004.

Impact of lapses on reserves and solvency margin

a) For an Endowment type of product (with profits): (for a typical endowment policy of term 15 years with age at entry of 35 years and sum assured of 25000/-)

Duration since inception (years)	per unit increase in lapse rate		per unit decrease in lapse rate	
	Change in statutory reserve	Change in solvency margin	Change in statutory reserve	Change in solvency margin
0-3	1.85	0.84	-1.84	-0.83
4-7	0.31	0.22	-0.41	-0.29
8-12	-0.08	-0.07	0.15	0.12
13-15	-0.50	-0.41	0.34	0.28

- Statutory reserve increased with increase in lapses up to seven year duration. After seven years, the statutory reserve decreased with increase in lapses.
- Statutory reserve decreased with decrease in lapses up to seven years. After seven year the statutory reserve increased with increase in lapses.
- Similar was the case with solvency margin. This clearly indicates that lapsation has asymmetrical effects on statutory reserves and on solvency margin.
- The observed changes in reserves might be due to the release of asset share for policies lapsed before acquiring surrender value which could result in increase in the surplus and thereby increase the liability towards existing policies. Hence per policy reserve increased.

- If the policy lapses after acquiring surrender value, no asset share would be released (unless the policy is surrendered) and there is no addition to the surplus from these policies. Hence per policy reserve was less affected.

b) For a Term Assurance Product: (for term assurance product with term 20 years with age at entry of 35 years)

Duration elapsed in years	per unit increase in lapse rate		Per unit decrease in lapse rate	
	Change in statutory reserve	Change in solvency margin	Change in statutory reserve	Change in solvency margin
0-8	0.00	0.00	0.00	0.00
9-15	-0.94	-0.03	0.75	0.06
16-20	-1.79	-0.04	1.96	0.05

- For a typical term assurance product, there was not considerable effect of increase/decrease of lapses on statutory reserve or solvency margin in the initial seven to eight years after inception of the policy. This was due to the fact that negative mathematical reserves resulting in the initial years lead to zero statutory reserves and constant solvency margin.
- In the later years of the policy, statutory reserves and solvency margin decreased with increase in lapses and vice versa. The level of change increased with duration.

c) For a Unit-Linked product: (for an age at entry 35 years with term of 15 years and sum assured of 2 lacs)

Duration since inception (years)	Change in statutory reserve	
	Per unit increase lapse rate	Per unit decrease in lapse rate
0-5	-0.15	0.32
6-10	-0.35	0.95
11-15	-0.78	0.57

Statutory reserve in respect of non-unit fund decreased with increase in lapses and the level of decrease was higher with duration elapsed since policy inception.

Effect of lapsation on profits of insurance company

a) For an Endowment type of product (without profits):

- For a typical age at entry, higher losses were observed with higher lapses in the first policy year which might be due to heavy initial expenses for which loading has been spread over the term of the contract and high negative asset share.
- After the first policy year and up to the period during which no surrender value was payable, the profit increased with increase in lapses which might be due to the nil

outgo from the company on lapses and the total asset share released the profit to the company.

- At the first one or two year duration, over which surrender value begins to become payable, the profit for the company increased with lapses but the increase was smaller than that before the surrender-eligibility period.
- Profit increased even at later durations due to excess of asset share over the surrender value.
- The rise in profit with rise in lapses increased with duration after the commencement of surrender-eligibility period.

For a typical endowment policy of term 15 years with age at entry of 35 and sum assured of 25000

Duration since inception(years)	Change in profit	
	Per unit increase in lapse rate	Per unit decrease in lapse rate
0-1	-7.99	4.47
1-6	0.93	1.35
7-10	0.91	0.92
10-15	0.95	0.61

b) For a Term assurance product:

- For a typical term insurance product, profits decreased with increase in lapses at all most all durations of the term. The rate of decrease was higher in initial years than in the later years.
- The decrease in profits with increase in lapses could be attributed to i) low premiums charged which do not cover the expenses unless received fully ii) increase in lapses resulting from selective withdrawals which tend to increase the average mortality of the remaining policyholders exposed to risk and hence mortality cost increases.

For term insurance product with term 20 years with age at entry of 35 years,

Duration since inception (years)	Change in profit	
	Per unit increase in lapse rate	Per unit decrease in lapse rate
0-3	-0.16	0.84
4-8	-0.39	2.01
9-12	-0.23	0.37
13-19	-0.65	0.85
19-20	-0.09	0.13

c) **For a Unit Linked Product:** (For an age at entry 35 years, Sum assured of 2 lacs and term of 15 years)

- Higher profit/lower loss was observed with higher lapses in the first three years. However, the level of increase in profits decreased as the duration elapsed which could be low initial allocation rates and high surrender penalties. In later years of the policy term, higher lapses resulted in decrease in profits and the level of decrease increased with duration.
- Converse was the case with decrease in lapse rate.

Duration since inception(years)	Change in profit	
	Per unit increase in lapse rate	Per unit decrease in lapse rate
0-3	0.16	-0.28
4-10	-0.24	0.67
10-15	-0.71	0.57

Recommendation:

It is recommended to have a uniform grace period of 30 days for annual, half yearly and quarterly modes and 15 days for monthly mode and to consider a policy lapsed if the premium is not paid within the grace period. (Uniform “Grace Period” and uniform “Lapse Definition” across the industry shall go together.) Policies, for which the premiums are paid after the grace period date may be treated as reinstatements, provided the premium is paid within the revival period of 2 to 5 years, as per insurers’ internal practice. Companies may be asked to follow this definition even for reporting purposes to IRDA.

CHAPTER – I

Introduction*

1.1.1 One of the important factors affecting the health of life insurance companies is lapses. In general, lapse is the discontinuance of the policy by non-payment of premiums due. It is important to understand difference between surrender and lapse, as surrender refers to a situation where the policyholder surrenders his policy and takes the surrender proceeds as specified in the product literature / policy document. Hence, there is a well informed separation of policyholder from the company. Whereas, in the case of lapses, within some specified time, the policyholder may revive the lapsed policy by paying all the premiums which are due on that date and proving continued insurability. But, the proportion of such revivals is less than 3% and hence majority of lapses are permanent in nature.

1.1.2 In a pure term product where there is neither surrender benefit nor maturity benefit the lapse will result in a loss to the company if asset share under the policy is negative at the time of lapse. Whereas in the case an endowment product the asset share is built over the period of time and if the lapse occurs in the initial phase of the policy then this would result to a loss to the company because companies will not be in a position to recover the fixed cost incurred in writing the policy. Whereas, if the lapse occurs at a later period then the company may be profited by forfeiting the mathematical reserves built under that policy. Moreover, if the lapses are high in the initial phase, companies will not be in a position to recover the fixed cost and hence, the deficit in fixed cost recovery is to be borne by the shareholder. This seems to be amply recognized in India at this hour as many private sector companies have less than 4 / 5 years of their existence and hence lapses would have significant impact on the financial health of the company.

1.1.3 Estimation / study of lapse rates is useful for i) pricing the insurance products and reviewing if the premium rates are lapse supported ii) valuation of insurance liabilities, iii) comparison of experience with other countries iv) bench marking industry lapse rate v) as back ground information in product development vi) identification of changing needs of the insured public and vii) identifying the factors influencing the lapse rates and hence the changes required in various parameters including marketing strategies.

1.1.4 Having recognized the importance of lapses, it was felt necessary to undertake a detailed study of lapses across various products and across various durations of the policy. With this objective, this study was undertaken and it was decided to collect data from all life companies for the period 2002-03 to 2006-07 for all individual life policies.

* This study was done by Dr. R. Kannan, Member; Mr. A.V. Rao, Deputy Director and Mr. S.K. Sarma, Assistant Director of the Actuarial Department of IRDA and. Sri K.P. Sarma then Appointed Actuary of Met Life Insurance Co Ltd.

We are thankful to Mr. Fabian Jeudy , Appointed Actuary of Birla Sun Life Insurance Co Ltd, Mr. Chandan Khasnobis, Appointed Actuary of Aviva Life Insurance Co Ltd, Mr. S.P. Subhedhar and to the participants of CILA conference held in Mumbai (Aug 29-30, 2008) for their comments.

We are indebted to Shri C.S. Rao, former Chairman of IRDA and to Shri J. Hari Narayan, Chairman, IRDA for their continuous encouragement and guidance in the preparation of this study.

The views expressed in this study are those of authors' and in any way do not reflect the views of the Authority.

1.1.5 It was decided to analyze the data using appropriate statistical techniques to help identify significant factors which lead to variations in lapse experience. These naturally warrant use of ANOVA methods.

This study consists of seven chapters. The first chapter mainly deals with required data collection, its limitations and how the limitations have been addressed. The second chapter briefly describes about the lapse rates and its role in pricing a product. The third chapter reflects the trends observed in lapse rates for the industry over the last five years (2002-07). The fourth and fifth chapter focuses on the analysis of lapse rates with single factor and two-factor data. Conclusions drawn are outlined in the sixth chapter. Recommendations for the future study, including alternative approaches in the estimation of lapses, have been dealt with in the seventh chapter.

1.2 Collection of data required for the study

1.2.1 All the sixteen life insurance companies were requested to furnish the data pertaining to lapses for the financial years from 2002-03 to 2006-07 with reference to the single factors as mentioned in **Annexure-1** using the company's own definition of lapse and below mentioned definition of exposed to risk.

Exposed to Risk Definition: Example for 2002-03

To consider lapses with respect to *number* of policies,

- Lapses contribute to exposure for one full year.
- Exposed to risk during the financial year for a policy is number of days from 1st April 2002 or date of entry into observation, if later, till 31st March 2003 or date of exit, if earlier, divided by 365.

To consider lapses with respect to *premium*,

- If a policy is lapsed, the total annual premium is taken as lapsed and the policy contributes one full annual premium to the exposure.
- Exposed to risk during the financial year for a policy is number of days from 1st April 2002 or date of entry into observation, if later, till 31st March 2003 or date of exit, if earlier, divided by 365 and multiplied by the annual premium.

It may be noted that a policy surrendered during the free look period has not been considered a lapse.

1.2.2 Companies were asked to furnish the data in form of tables given in **Annexure-2**

1.2.3 The companies were also requested to furnish the data pertaining to lapses for the financial years from 2002-03 to 2006-07 with reference to important combinations of two factors at a time using the company's own definition of lapse and definition of exposed to risk as mentioned in 1.2.1.

The combinations as mentioned in **Annexure-3** were considered crucial for data collection.

1.2.4 Companies were asked to furnish the data in form of tables given in **Annexure-4**.

1.2.5 DATA and STUDY

A questionnaire as follows was also asked to be answered from companies to supplement the above data.

1. Define when a policy is considered lapsed
2. Does the definition of lapse vary across the products? Give details.
3. Whether this definition is conveyed to other departments of the company so that uniform definition is followed?
4. What is the definition of lapse used for the purpose of valuation?
5. Has the company done any experience study? If so, please provide details.

1.2.6 SURVEY OF CAUSAL FACTORS

I. Terms of remuneration to Distribution channels

- a) Are the first year commissions paid to different channels the highest permitted under the statutory provisions? If they are lower, state what is the differential in percentage terms. Give your answer separately for each channel.
- b) Apart from commissions what extra support is provided? State what is the extra expense involved as an approximate percentage to a) above.
- c) Are the second and third year commissions paid to different channels the highest permitted under the statutory provisions? If they are lower, state what is the differential in percentage terms. Give your answer separately for each channel.
- d) Are the fourth and subsequent year commissions paid to different channels the highest permitted under the statutory provisions? If they are lower, state what is the differential in percentage terms. Give your answer separately for each channel.
- e) Do the intermediaries get recognition for their efforts in reduction of lapses of policies in –i) financial terms and/ or ii) other ways? In case of i) indicate approximate cost as a percentage of total commission.

II. Servicing Standards

- a) How many days before the renewal premium (including first year renewal) is due, notices for dues scheduled to be sent to policyholders?
- b) Does the company also send reminders to policyholders for defaults in payment of premiums? If so, how many times?
- c) Is final default /lapse notice sent to policyholders? If so, at what point of time?
- d) Are intermediaries also sent copies of notices mentioned in a) to c) above and, if so, state which of the above?
- e) Does the company run the periodical campaigns for revival of lapsed policies? If so, how many times a year?

1.3 Examination

1.3.1 Limitations of the data – Mitigation of their effect on final result

Data submitted by the companies were examined in detail. It was found that the data contained the following inadequacies.

- Inclusion of single premium policies by some companies – *Eliminated after due verification.*
- Inclusion of surrenders by some companies – *Not found significant hence ignored.*
- Inaccurate data under some of the reference factors – *Such data constituted less than 0.01% of the total data hence ignored.*
- Varied definition of lapse across the companies and also across the products within a company – *Definition of lapse under majority of companies found to be similar hence proceeded with the data as available.*
- Non-availability of data for years 2002-04 for some companies- *analyses with respect to each factor/combination of factors were based on data for years 2004-05 to 2006-07.*
- Wrong mention of data for some of the factors- *clarifications along with rectified data were obtained from the companies and also outliers (i.e those which are highly inconsistent with rest of the data) were not taken into consideration.*

* * * * *

CHAPTER – II

Lapse Rate-A brief outline

2.1 The following definitions are used in the study.

2.2 **Lapse Rate** is the rate at which life insurance policies terminate because of failure to pay the renewal premiums by the policyholders on stipulated dates.

Once the policy is lapsed it can be treated by the insurer in either of the following ways depending on the period for which the premiums were paid.

1. **Pure lapsed policy:** The policy may be treated as a lapsed policy without any value i.e. the policy doesn't acquire any policy benefit payable to the policyholder during the period before reinstatement. Policy lapsed in this way is called a pure lapsed policy. (Reinstatement is the process of bringing a lapsed policy into force by payment of all the un-paid premiums with interest subject to certain other requirements relating to health.)
2. **Paid up policy:** The policy lapsed may not be treated as fully void but it will be treated as in-force for a reduced value during the period before reinstatement in which case the policy will be called a paid up policy.

2.3 When policies are lapsed before enough premium payments are made to cover initial expenses on procuring a policy, and gap during early policy years in actual expenses and expense recovery implied in pricing premiums, the company has to make up this loss from remaining policyholders. Therefore, the lapse rate will have effect on the financials of the insurer.

It is the ratio of the number of life contracts that have lapsed within a specified period of time to the number in force during the period. This ratio can also be based on premium amounts instead of number of policies.

Lapse rate in any financial year, say from 1.4.2007 to 31.3.2008, is the ratio of number of policies lapsed during the financial year to the total number of policies in-force during 1.4.2007 to 31.3.2008.

Mathematically speaking,

Annualized Lapse Rate = Amount lapsing during the year / Amount exposed to lapse during the year.

Terminations due to death, disability, expiry maturity or conversion are not included in the amount lapsing and contribute to exposure for the fraction of the year they were in force.

2.4 Withdrawal (lapse rate) experience – the factors by which the data could be analyzed, in broad order of importance, are:

- *type of contract* – eg: term assurances have different withdrawal rates from with-profits endowment assurance as the policyholder loses little on withdrawing from the former
- *duration in force* –this is the period in years from the commencement of the policy; withdrawal rates are generally higher near the start of the contract
- *sales method used and target market* – the degree of care taken in ensuring that a suitable product is sold may depend on the sales method and target method. The more suitable the product, the lower will usually be the withdrawal experience. However, as a proxy, agency type is used for sales method and sex and area of address of policyholder is used as for target market.
- *frequency and size of premium* – with monthly premiums there are more opportunities to withdraw than if premiums are annual. A high premium relative to income will be harder to afford than a smaller one, but a small one may not be considered worthwhile continuing with. This is classified as ‘mode’ in the analysis.
- *premium payment method* – premiums paid in cash are more noticeable than premiums paid directly from a bank account and so lead to higher withdrawal rates. This has not been used in the current analysis.
- *original term of contract* – this is the number of years over which the policy contract is agreed to run.
- *sex and age* – experience tends to be different for females and for younger ages. Normally age at entry on policy commencement is used for the analysis.

It may be noted that these are just some of the factors by which an analysis of withdrawals experience *could* be made and withdrawal rates are significantly influenced by social, economic and commercial factors, which are notoriously difficult to predict.

2.5 Role of withdrawal (lapse rate) assumptions in pricing a product

The withdrawal assumptions should reflect the expected future experience in respect of the contracts that will be issued .

The parameters of mortality will be based on a model of the selective effect of withdrawals. Departures from the latter may invalidate the former.

If a company is recouping initial expenses gradually over the term of a contract then there is a mismatch in the timing of income and outgo. The amount of charges to recoup the initial expenses will have been set, when the contract was priced, on the basis of assumed rates of future withdrawals. Higher than expected withdrawals would then make the future income from these charges inadequate to repay the initial expenses.

The per-policy fixed expenses increase due to the loss of business volume from withdrawals. It may be possible to counter this at some duration by giving the policyholder a surrender value low enough for the insurance company to recoup its expenses, and perhaps even make its required profit. However, changes in withdrawal experience from the rates originally assumed in pricing leads to different sensitivities at different policy durations and an office will have to carefully track such sensitivities and the impact on profit solvency position of the company.

CHAPTER – III

Trends observed in lapse rate for the industry over the last five years

3.1 This chapter provides an outline of the overall lapse rate over the observation period 2002-03 to 2006-07. The total lapses and exposures during the period were as following.

	Lapses	Exposed to risk	Ratio
Number	5.226 Crore life-years	73.419 Crore life-years	7.11%
Premium	Rs. 20,521.501 Crore	Rs. 3,36,183.058 Crore	6.10%

3.2 Trends observed in lapse rate for the industry over the last five years

3.2.1 For the entire industry

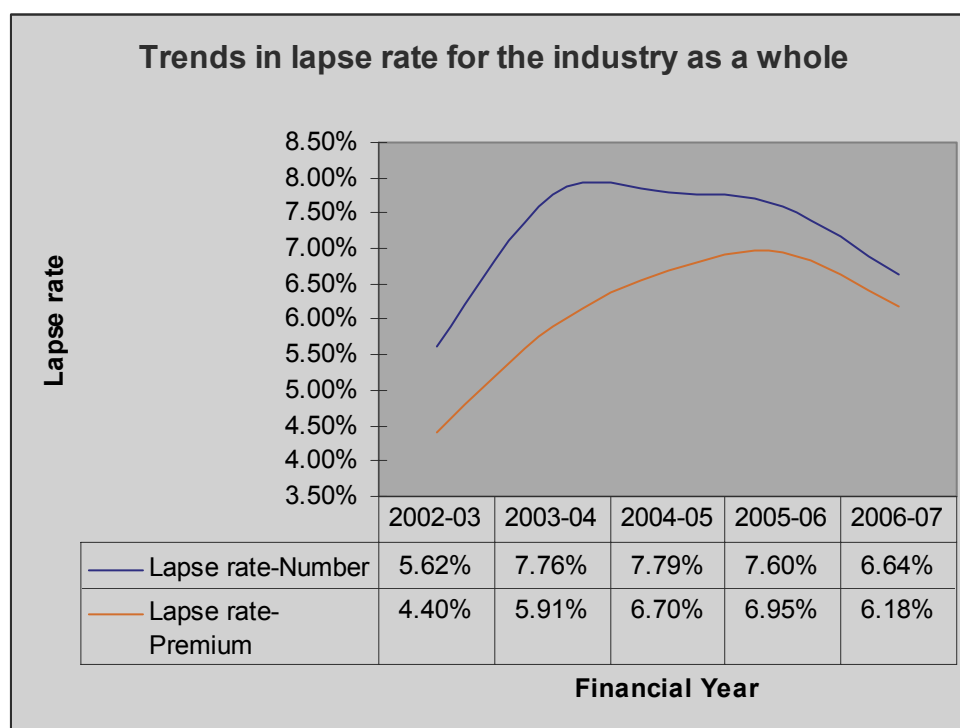


Figure 1

From the above figure, industry lapse rate with respect to number of policies increased from 5.62% to 7.79 % and decreased slowly from 2004-05. Lapse rate with respect to premium increased from 4.40% to 6.95% slowly increasing year by year excepting a small decrease in 2006-07. The lapse rate on premium basis is lower because fewer policies with larger premium were discontinued.

3.2.2 Need for grouping of companies:

Observation of average lapse rate for 2004-05 to 2006-07 revealed wide variation in lapse rate across the companies (7% to 35%).

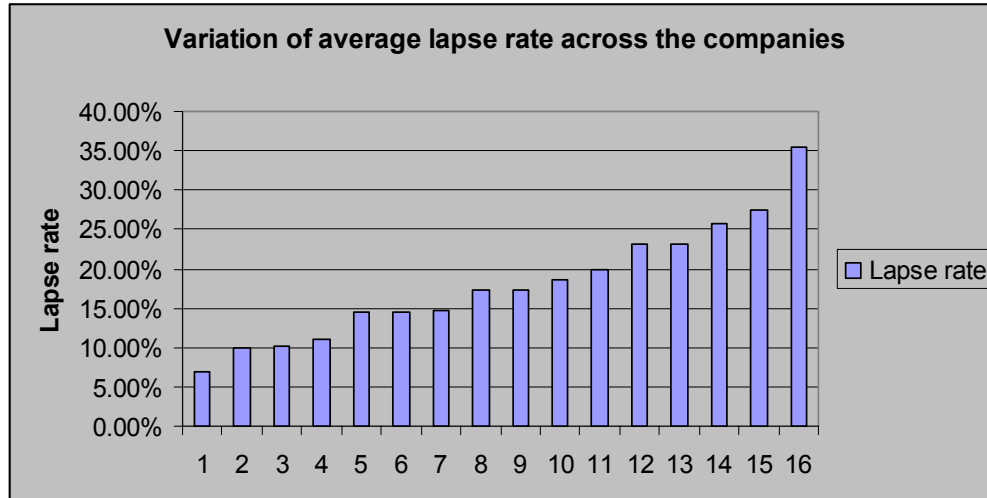


Figure 2

It was also observed that industry trends were mostly dominated by few companies (called **Group-I companies** hereafter) having lapse rate less than or around 10%. Hence it was felt necessary to make some analysis separating these low lapse-rate companies from others (called **Group-II companies** here after) to get more obvious picture regarding level of lapse.

3.2.3 For Group-I companies

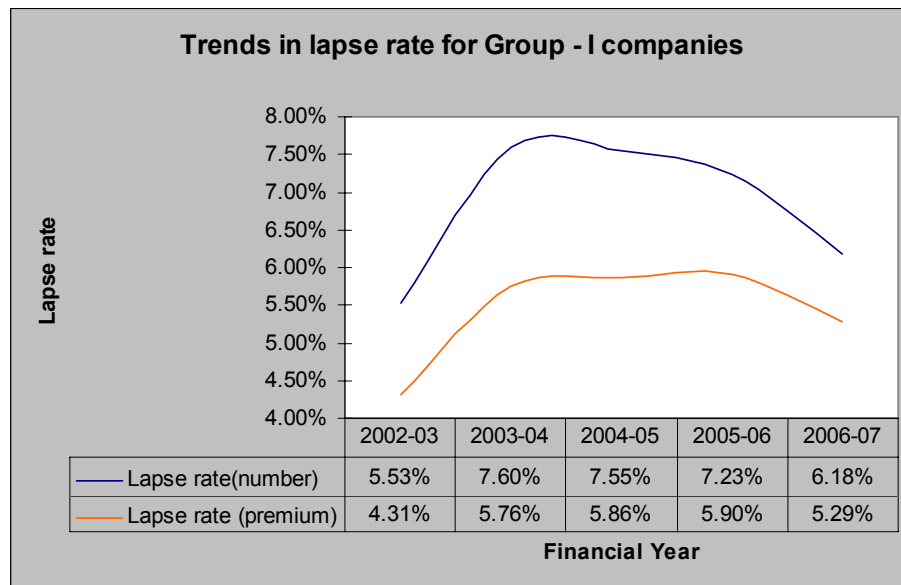


Figure 3

3.2.4 For Group-II companies

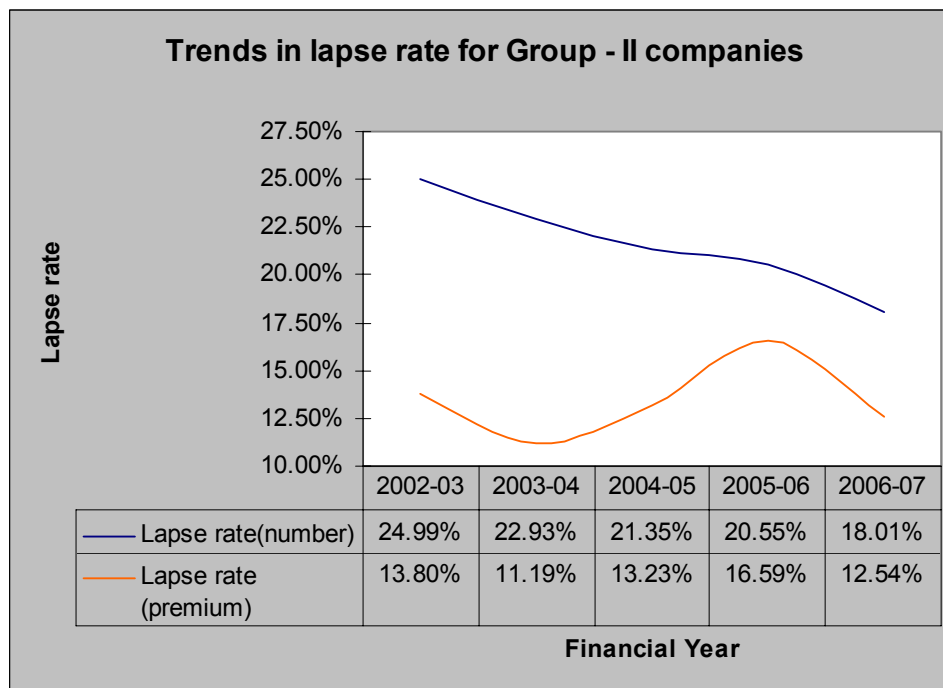


Figure 4

3.2.5 From **figures 3 & 4 above**, the following can be observed. In case of Group-I companies, number- lapse rate increased from 5.53% to 7.60% in 2003-04 and continuously decreased thereafter to 6.18% in 2006-07. For Group-II companies the lapse rate with respect to number decreased continuously from 24.99% to 18.01%. In case of Group-I companies premium-lapse rate increased continuously from 4.31% to 5.90% and then declined to 5.29% in 2006-07. But on the same premium basis the Group-II companies exhibited lapse rates which are significantly higher and touched the peak rate of 16.59% in 2005-06 but declined to 12.54% in 2006-07.

3.2.6 On observing company wise trends in lapse rate with respect to each financial year from 2002-03 to 2006-07, seven companies out of sixteen showed more or less a decreasing trend from 2003-04. For one company, the lapse rate showed a decreasing trend over the last three years. For two companies the lapse rates had been increasing more or less since 2003-04 till 2006-07 which could be a serious cause of concern for those companies and proper measures may have to be taken to reduce the same. Alternatively, there is a need to ascertain whether the companies are making any profits out of lapses. However, there was a vast difference in the scales of lapse between the companies. For two companies the lapse rate had been more or less constant from the year 2003-04 though there was a vast difference in the scales of lapse between these two companies.

3.2.7 Lapse rate for seven companies out of sixteen exceeded the industry average (simple arithmetic mean) of 18% (number lapse rate) and 11.9% (premium lapse rate). However, majority of the companies exceeded the industry average rate (weighted average with weights being premium exposed to risk) by a considerable margin.

3.3. Duration-wise variation in lapse rate for each financial year

3.3.0. Lapse rates for group-I and Group-II companies for various durations elapsed from inception are as following from 2002-03 to 2006-07.

a) Number-lapse rates of Group-I companies

(in percentage)

Duration elapsed in years	2002-03	2003-04	2004-05	2005-06	2006-07
0-1	19.64	22.95	21.99	18.33	11.76
1-2	5.79	10.69	11.77	12.30	8.61
2-3	2.70	4.06	4.35	5.70	6.17
3-4	1.90	3.11	3.47	4.69	5.41
4-5	1.79	2.93	3.23	3.95	4.37

b) Premium-lapse rates of Group-I companies

(in percentage)

Duration elapsed in years	2002-03	2003-04	2004-05	2005-06	2006-07
0-1	11.12	13.6	13.68	11.67	8.23
1-2	3.76	6.7	7.95	9.07	7.55
2-3	2.01	3.21	3.41	4.28	4.87
3-4	1.58	2.57	2.87	3.89	4.26
4-5	1.58	2.61	2.8	3.16	3.51

c) Number-lapse rates of Group-II companies

(in percentage)

Duration elapsed in years	2002-03	2003-04	2004-05	2005-06	2006-07
0-1	21.82	26.73	26.40	23.69	15.73
1-2	36.70	19.02	20.18	21.00	27.37
2-3	48.41	12.68	11.24	18.12	15.01
3-4	-	6.87	9.12	7.89	11.33
4-5	-	-	-	4.25	6.96

d) Premium-lapse rates of Group-II companies

(in percentage)

Duration elapsed in years	2002-03	2003-04	2004-05	2005-06	2006-07
0-1	12.95	12.09	16.13	20.50	11.04
1-2	18.65	9.53	9.12	10.91	17.64
2-3	46.77	8.06	10.76	16.71	9.87
3-4	-	5.89	7.23	8.88	10.07
4-5	-	-	-	2.57	6.55

With the above data the following analysis has been made for each year.

3.3.1 Financial Year 2002-03:

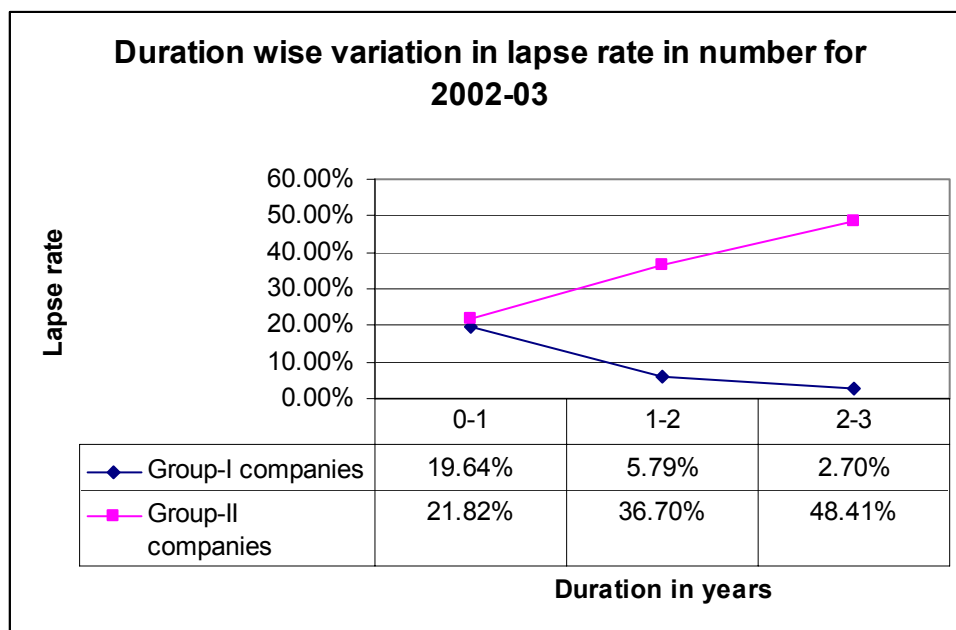


Figure 5

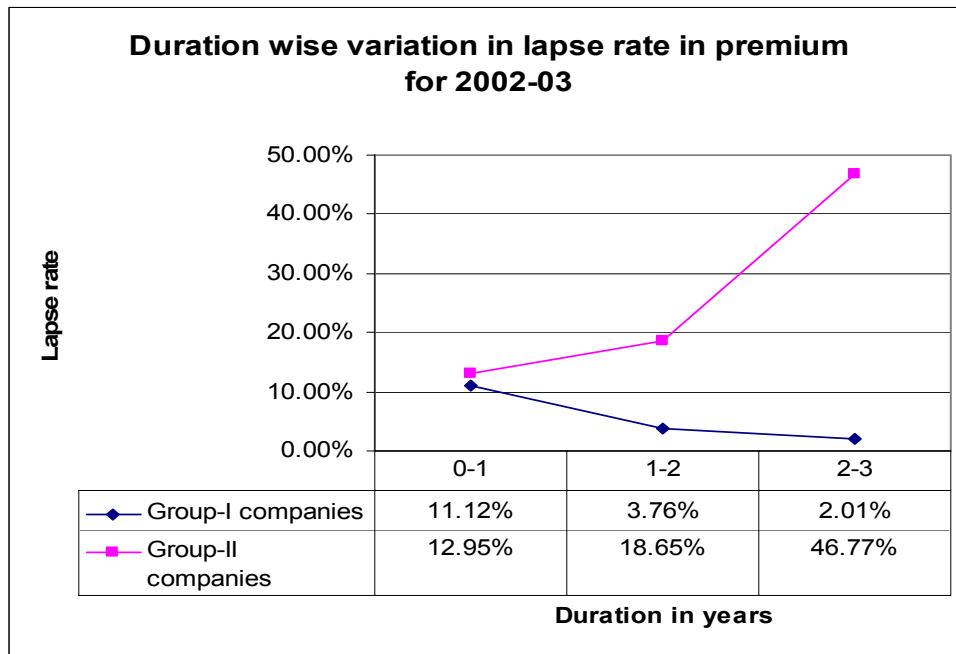


Figure 6

From the above figures, it can be observed that the group-II companies showed a peculiar trend of increasing lapse rate (with respect to both number and premium) with increase in duration elapsed. (It is generally expected that lapse rate decreases with increase in duration elapsed.) This trend might have resulted due to nascent state of many insurance companies and volume of data observed for these companies being low. However, this feature could also be due to selling policies with premium beyond the means of policyholders.

For the group-I companies, lapse rate with respect to both number and premium is observed to be decreasing with duration elapsed.

Lapse rate with respect to new business is observed to be almost at the same level for both the groups of companies.

3.3.2 Financial Year 2003-04:

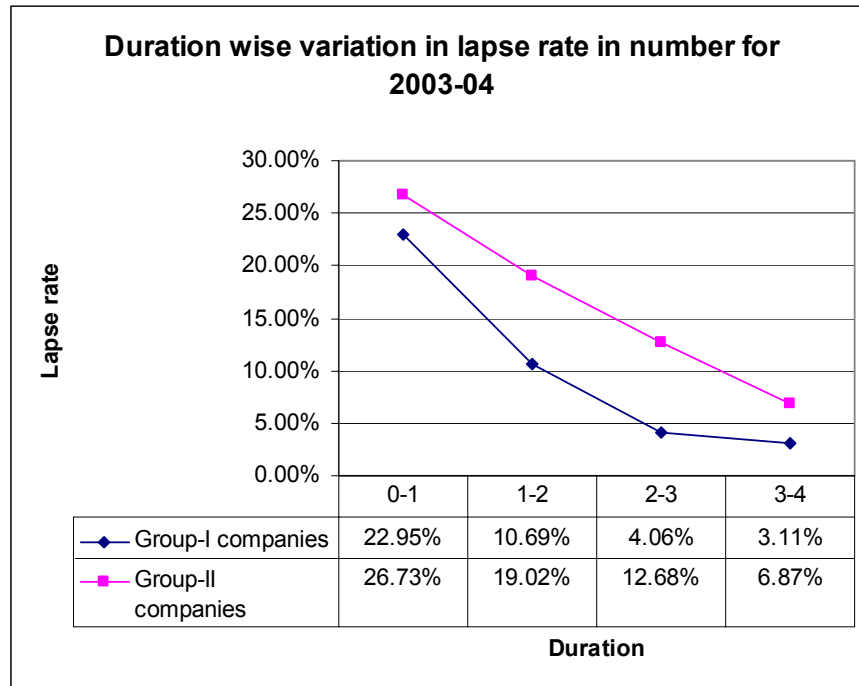


Figure 7

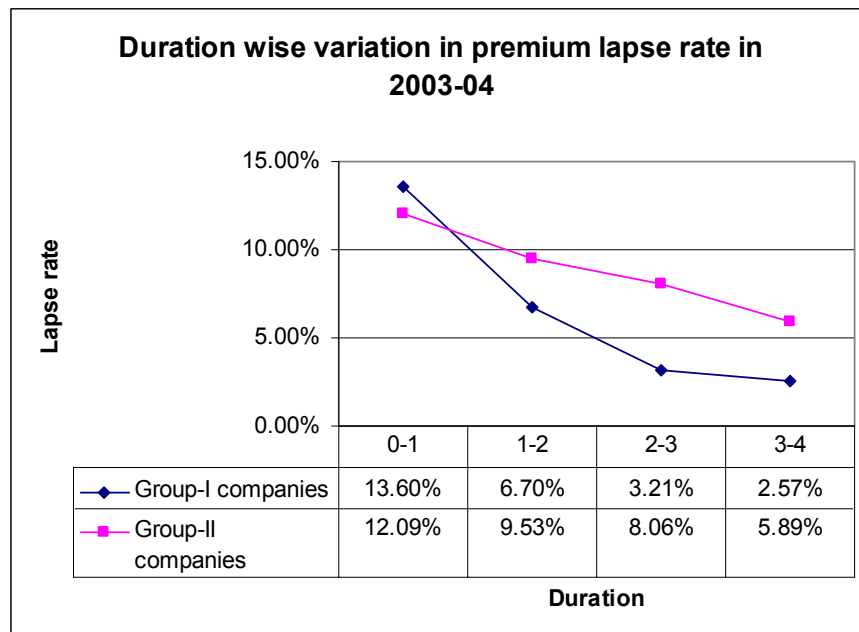


Figure 8

Both groups of companies were observed to show a decreasing trend of lapse rate with increase in duration elapsed.

With respect to number of policies lapsed, the group-II companies were observed to show higher lapse rate than the group-I companies at almost all durations.

With respect to premium lapsed, the group-I companies were observed to show higher lapse rate than the group-I companies at duration 0⁺ years with trends at other durations remaining the same as with number-lapse rate.

3.3.3 Financial Year 2004-05

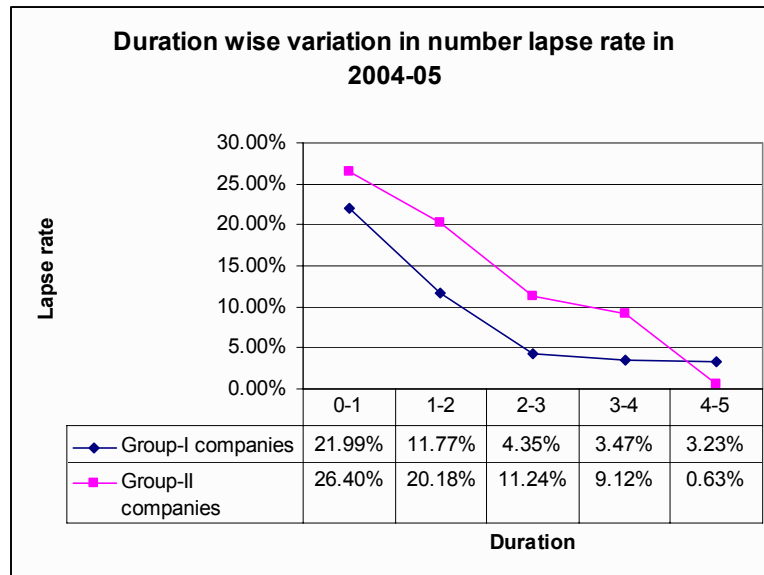


Figure 9

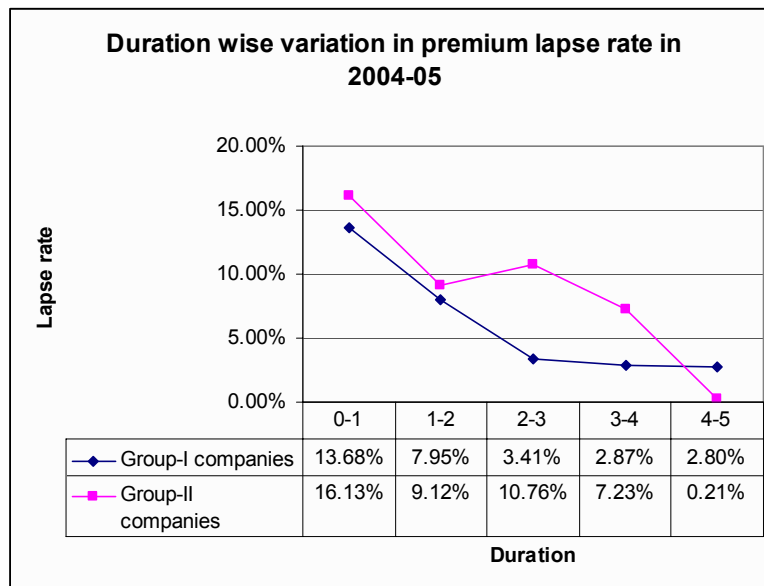


Figure 10

From the figures 9 & 10, it can be observed that with respect to number of policies lapsed, the group-II companies show higher lapse rate than the group-I companies at almost all

durations. The deviation observed at duration around 4 years might be due low volume of data for group-II companies.

The group-I companies showed decreasing trend with duration elapsed at all durations. However, the group-II companies are observed to show a deviation of such trend at duration of 2 years.

3.3.4 Financial Year 2005-06:

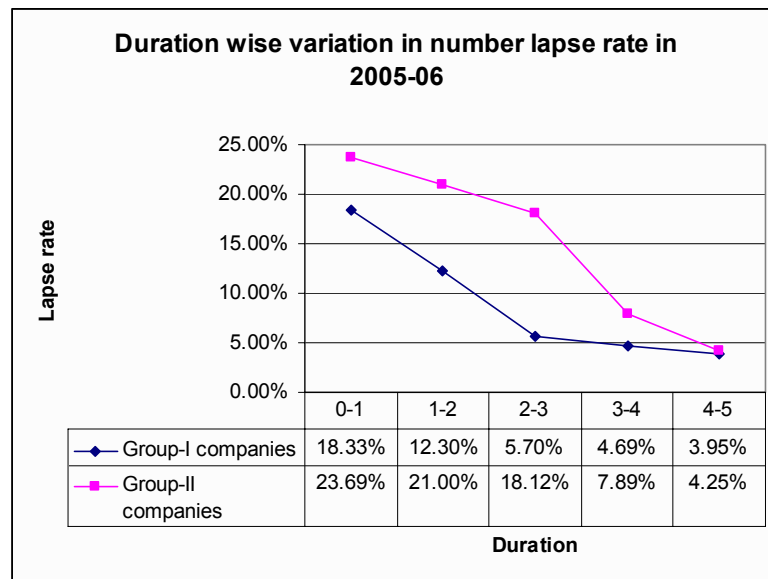


Figure 11

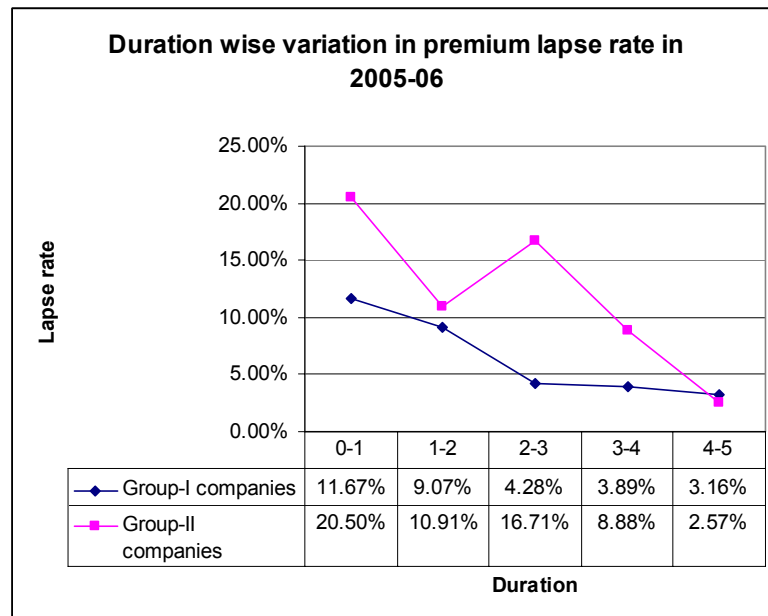


Figure 12

From the above figures, the trends observed were almost similar to those of financial year 2004-05.

3.3.5 Financial Year 2006-07:

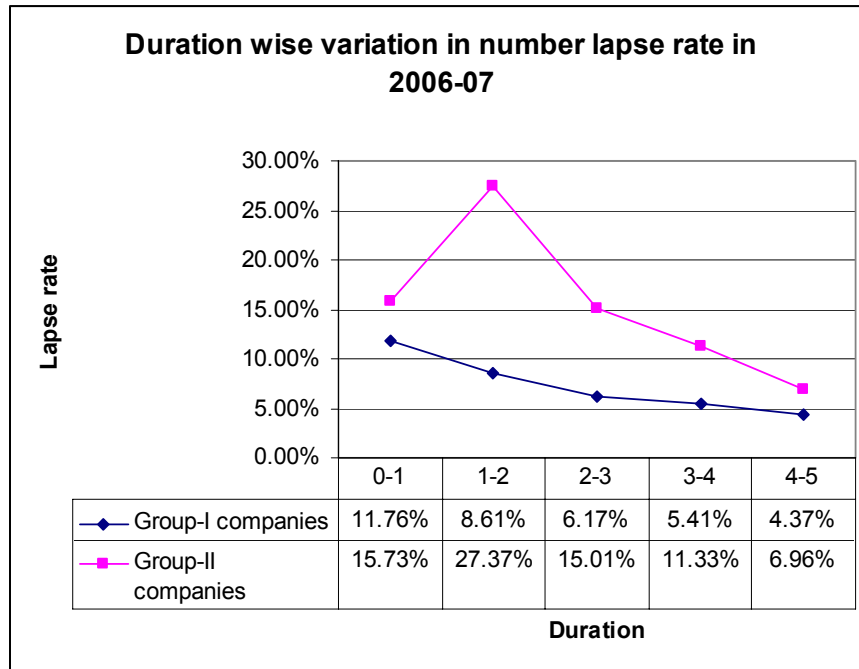


Figure 13

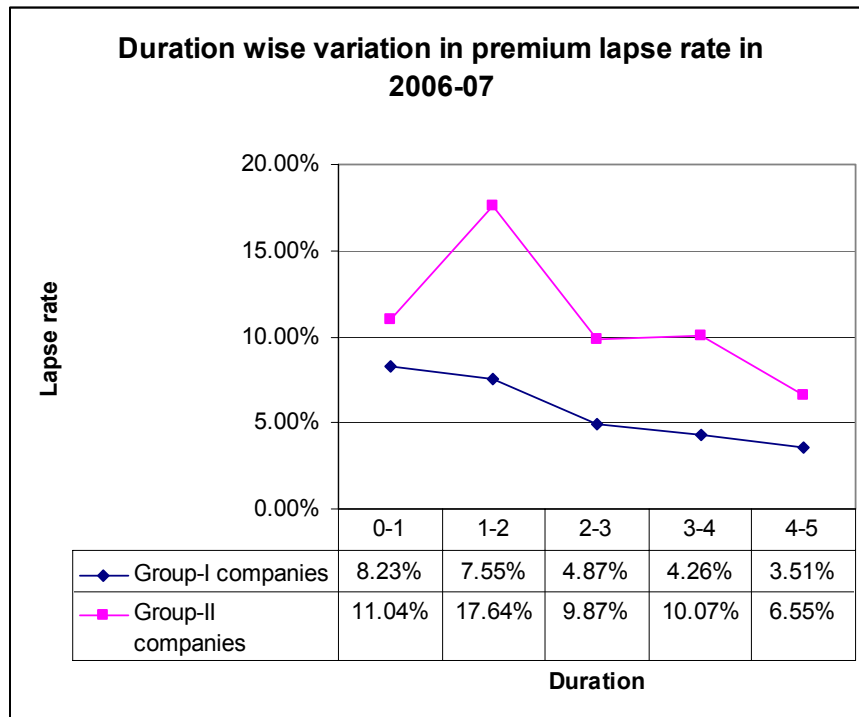


Figure 14

For the group-II companies, this financial year showed a peculiar trend of increasing lapse rate (with respect to both number and premium) with increase in duration elapsed

For the group-I companies, lapse rate with respect to both number and premium is observed to be decreasing with duration elapsed.

From the above figures (from figures 5 to 14) it can be observed that except for the financial years 2002-03 and 2006-07 the lapse rate showed an increasing trend with duration elapsed since inception for the group-II companies. For the group-I companies, lapse rate with respect to both number and premium is observed to be decreasing with duration elapsed in all financial years.

3.4 Trends observed in NB lapse rates from 2002-03 to 2006-07

The trends observed in lapse rate in the first policy year for financial years 2002-03 to 2006-07 were as following. The lapse rate plotted is obtained from the '0' duration lapses (i.e. those which had not completed one policy year since inception of the policy).

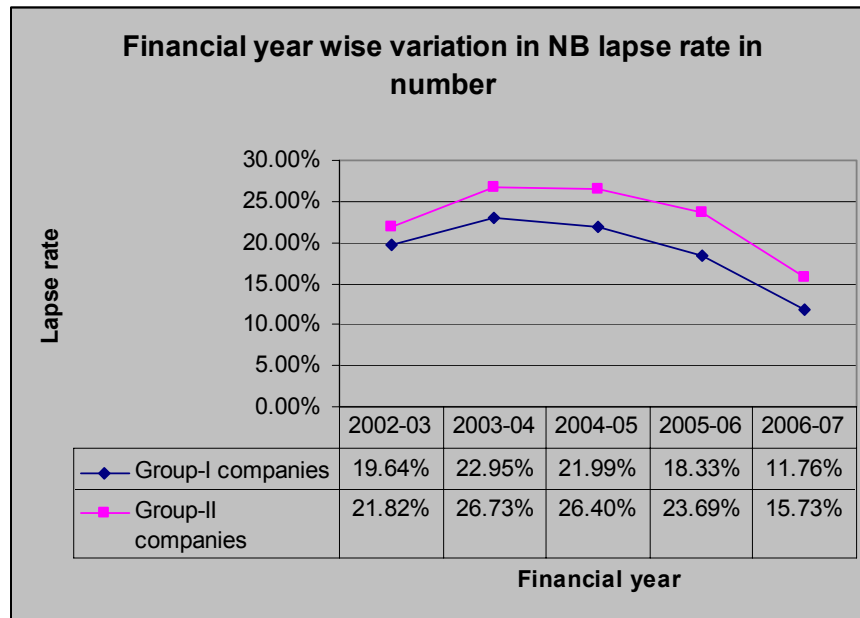


Figure 15

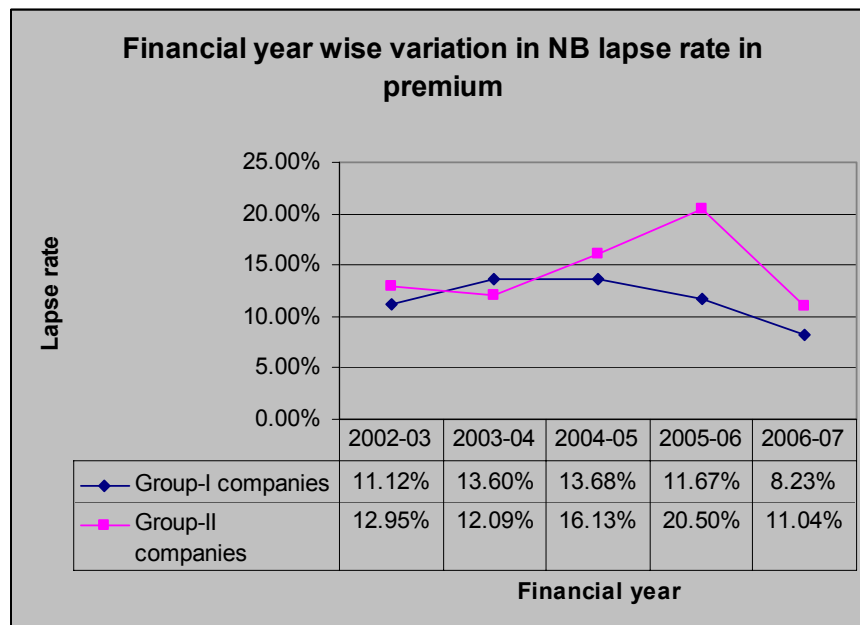


Figure 16

From figures 15 & 16, it may be observed that both groups of companies showed a similar trend with each other with respect to lapse rate in number, with lapse rate increasing up to 2003-04 and decreasing thereafter. But for the group-I companies the lapse rate varied from 8.23% to 13.68%, whereas for the group-II companies it varied from 11.04% to 20.5%.

3.5 Financial year wise variation in lapse rate for each product from 2002-03 to 2006-07

3.5.1 With profit Endowment type of product

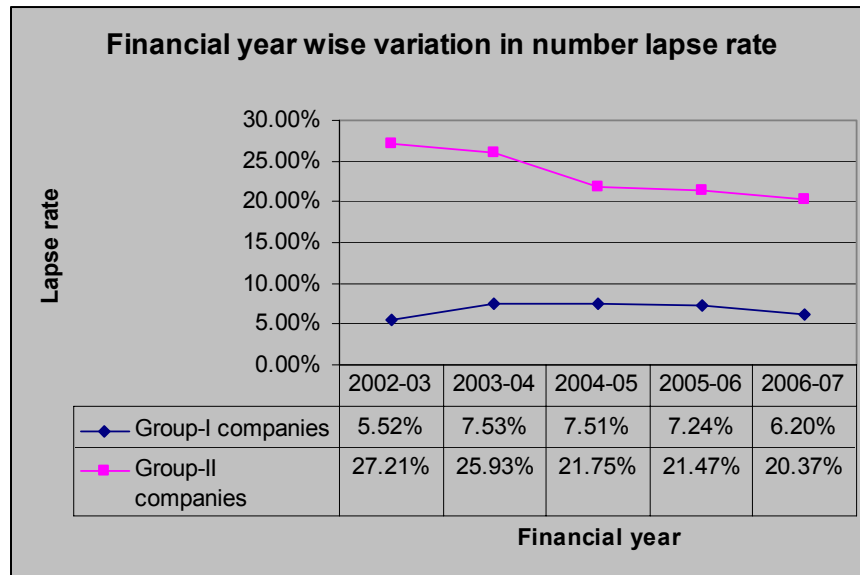


Figure 17

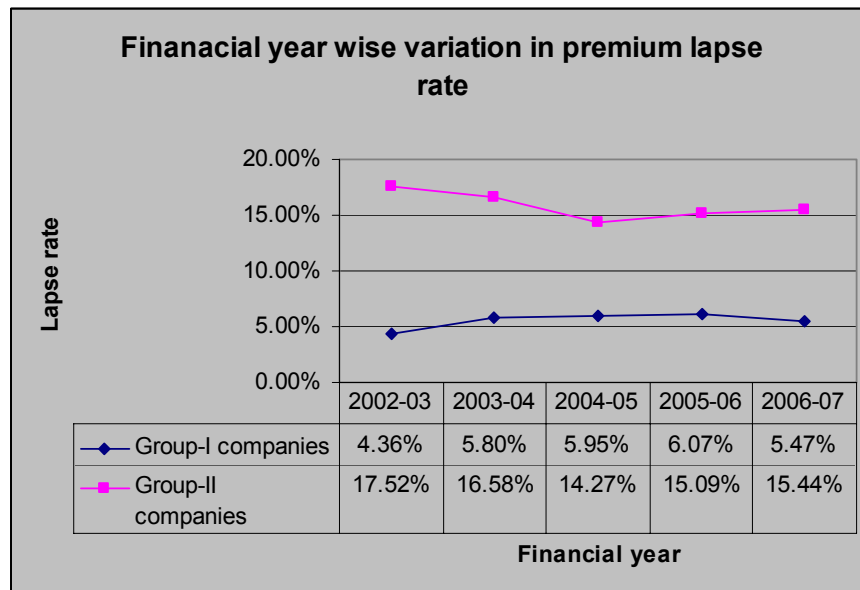


Figure 18

From figures 17 & 18 it can be observed that there is substantial difference in the lapse rates for Group-I and Group-II companies. Trends in lapse rate are almost similar since 2004-05 for both the groups.

3.5.2 Non-profit Endowment type product

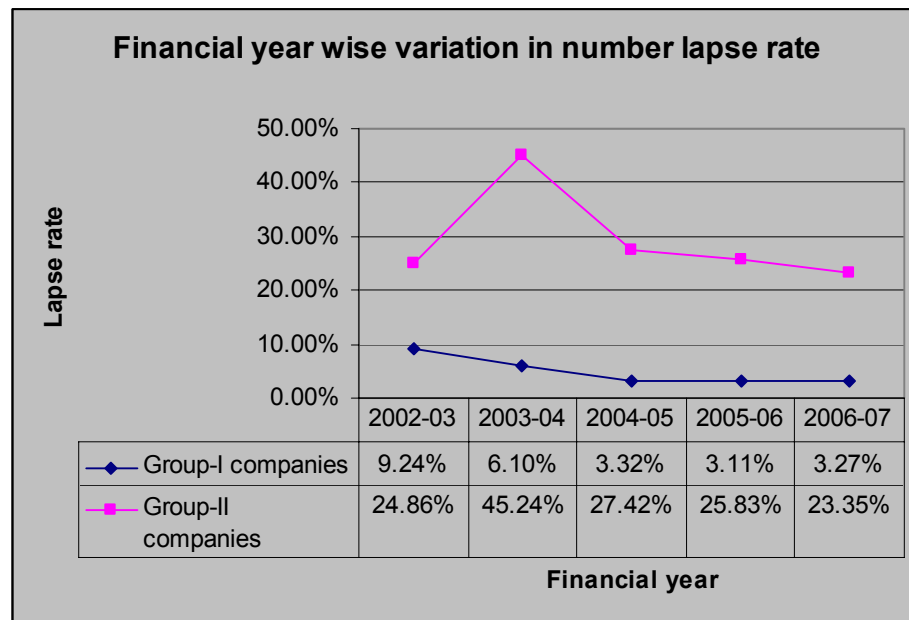


Figure 19

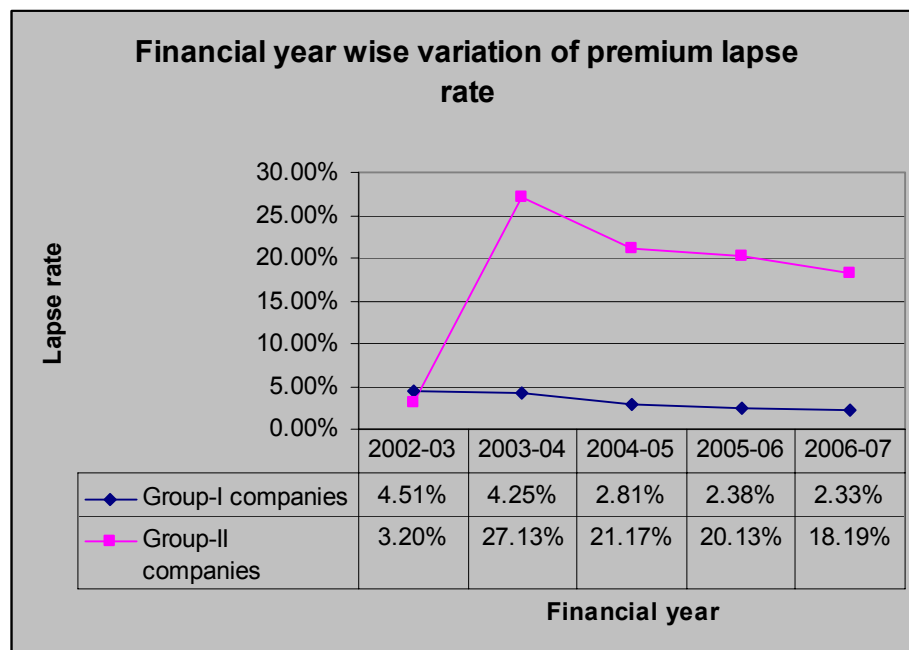


Figure 20

From figures 19 & 20, with respect to number of policies, lapse rate for group-I companies showed almost a decreasing trend from 2002-03 to 2006-07 and then increased in 2006-07

whereas with respect to Group-II companies premium lapse rate is observed to decrease from 2003-04 to 2006-07. One of the factors for the large difference in the lapse rates for Group-I & Group-II companies would be small volume of data for the Group-II companies under this product.

3.5.3 Term assurance product

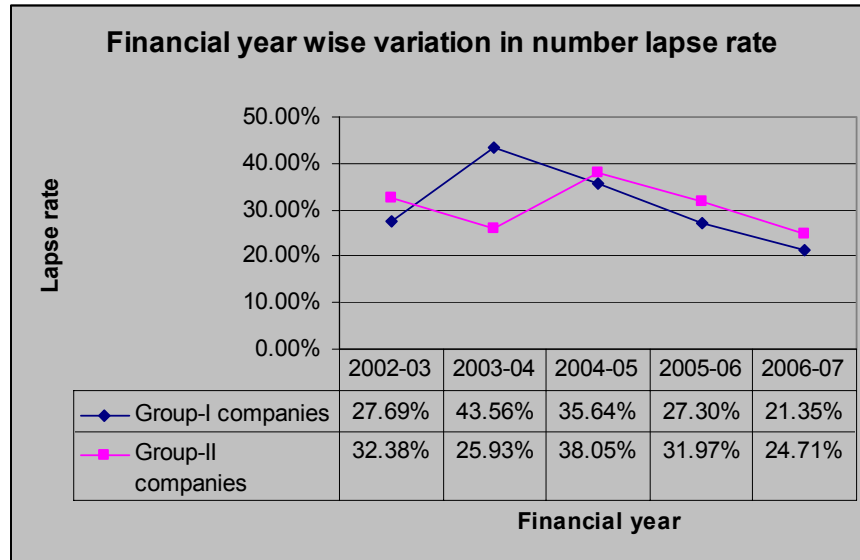


Figure 21

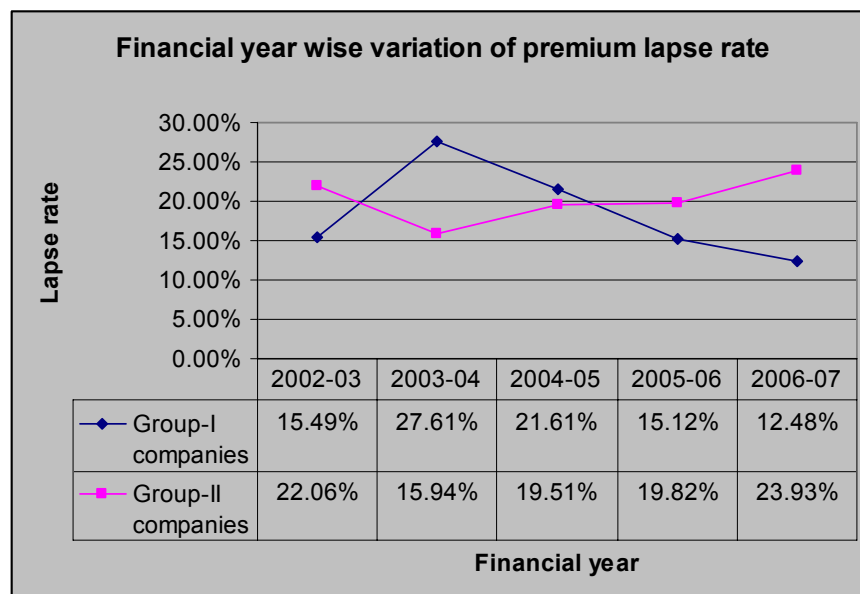


Figure 22

From figures 21 & 22, it can be observed that with respect to number of policies lapsed, group-I companies had a different trend to that of group-II companies. For group-I

companies the lapse rate had increased from 2002-03 to 2003-04 and decreased thereafter and for group-II companies, the lapse rate has increased from 2002-03 to 2003-04 and decreased thereafter. Also, in 2003-04 the lapse rate for group-I companies is higher than that of group-II companies.

A similar trend is observed with respect to premium lapsed with the lapse rate for group-I being higher than that under the group-II in 2003-04 and 2004-05.

3.5.4 With profit Whole life product

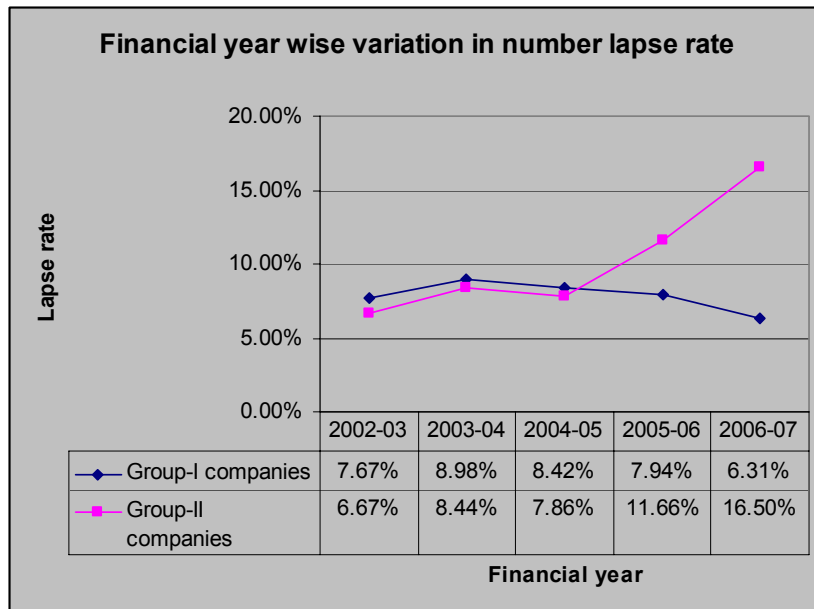


Figure 23

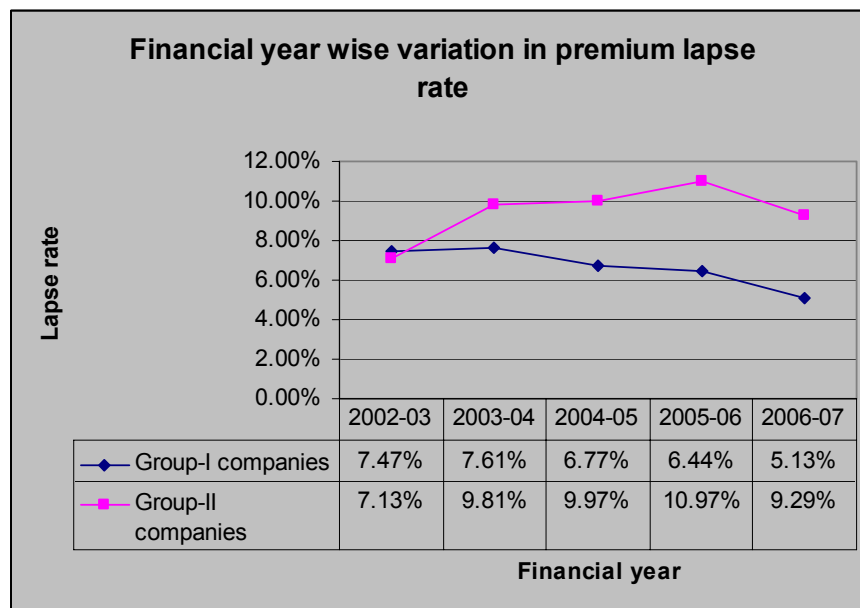


Figure 24

From figures 23 & 24, for the group-I companies the lapse rate with respect to number has almost remained around 8% where as for the group-II there is sharp increase in lapse rate from year 2004-05. However, no such sharp increase is observed with respect to premium lapsed. This might be due to higher lapses in low premium policies.

3.5.5 Non-profit Whole life product

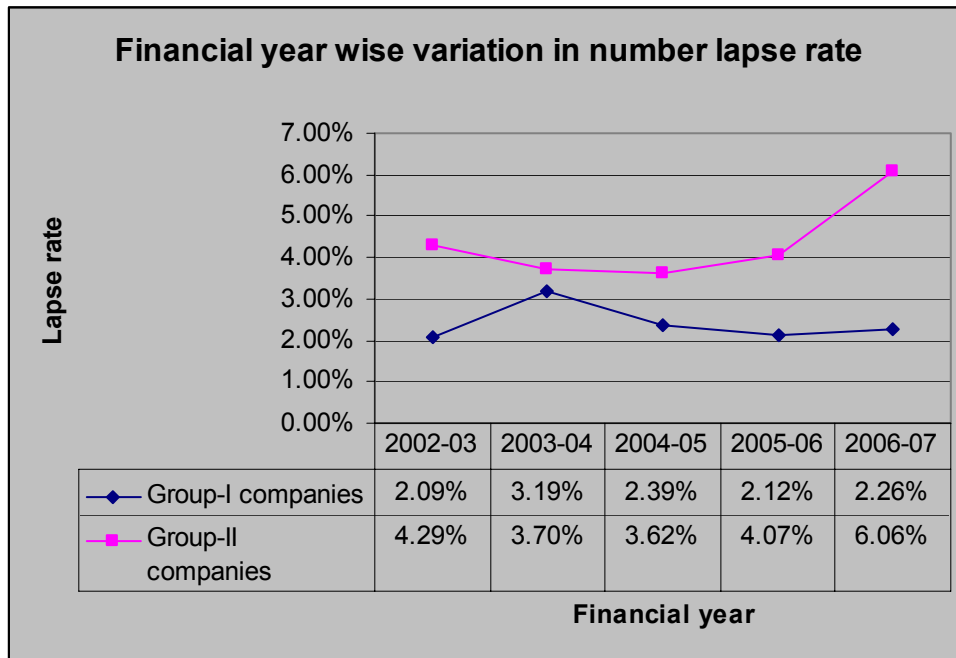


Figure 25

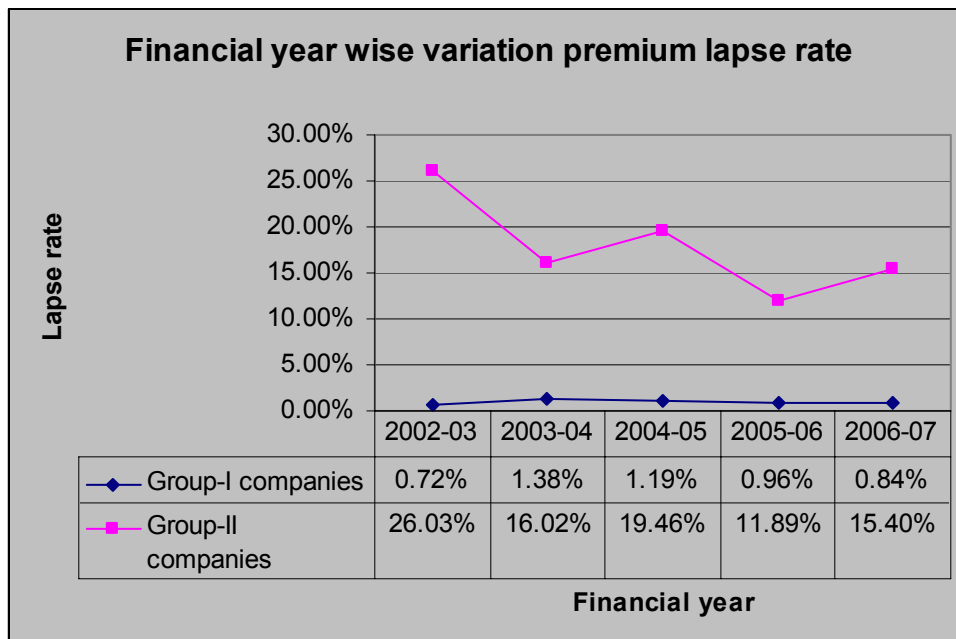


Figure 26

From the figure 25 it can be seen that lapse rate for group-I companies had almost remained around 2% to 3% for all years except in 2003-04 where it is 3.19% and for the group-II companies the lapse rate was around 3% to 4% with a rise to 6.00% in 2006-07.

From the figure 26 it can be seen that premium lapse rate for the group-I companies had almost remained around 1% for all years. Premium lapse rate for the group-II companies was observed to be far higher than the corresponding number lapse rate. Again part of this trend may be attributed to lapses in high premium policies.

3.5.6 Unit linked product

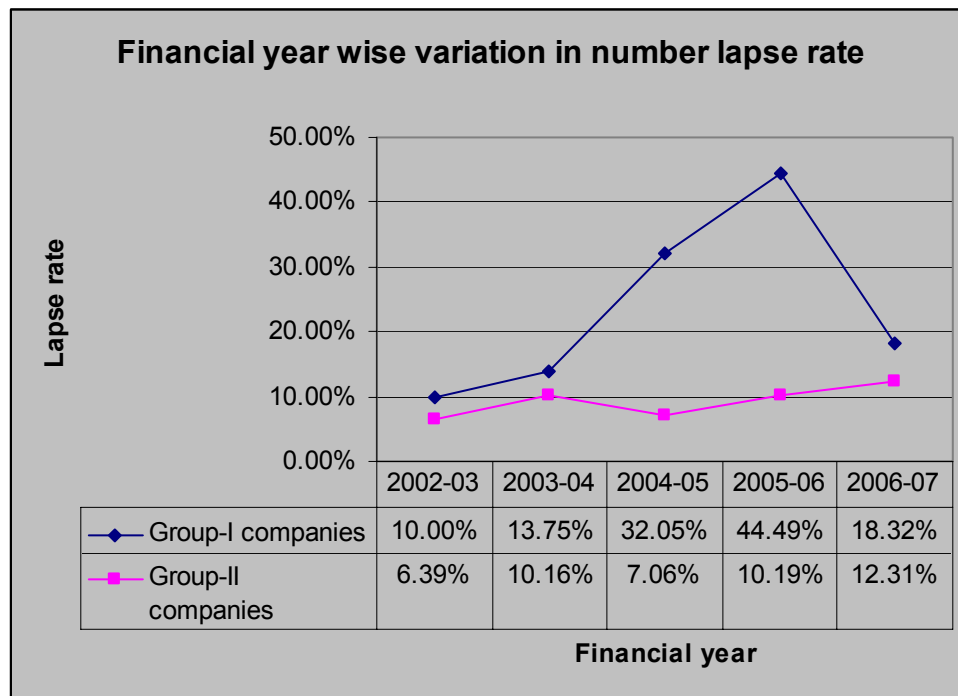


Figure 27

From figure 27, it can be observed that lapse rate for both the classes showed almost the same trend until 2003-04 and thereafter the group-I companies showed higher lapse rate than the group-II companies with a sharp increase of lapse rate to 44.5% in 2005-06 and decrease to 18.32% in 2006-07. While the lapse rate under the Group-II companies varies from 6.40% to 12.31% the variation corresponding to the group-I companies is from 10.00% to 44.49%. (Lapse rate for Group-I companies is an indication of sale with 3 year horizon.)

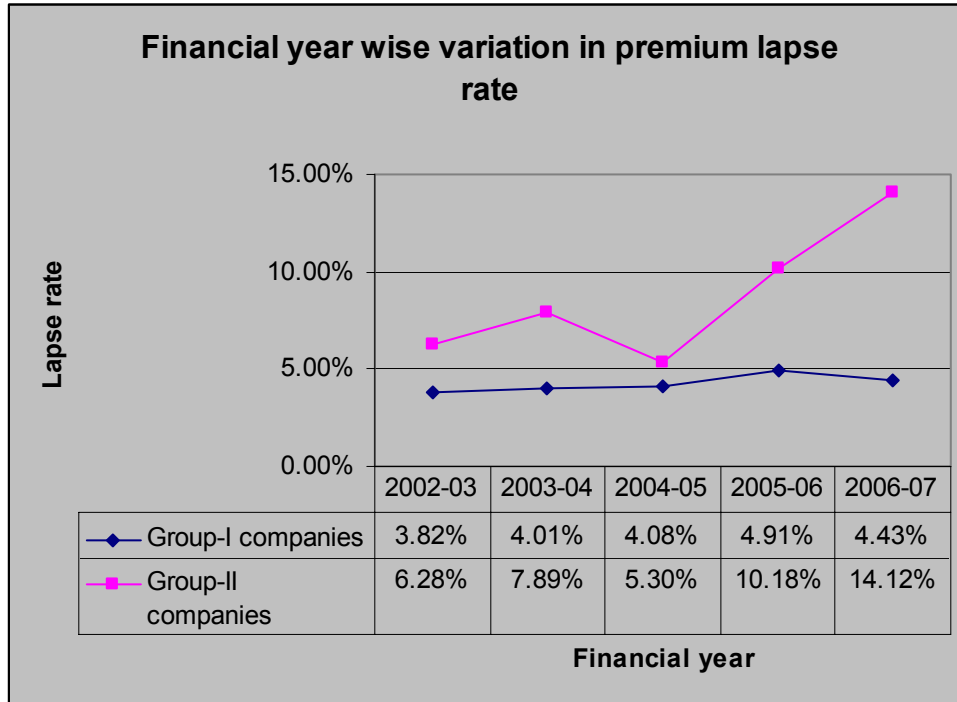


Figure 28

From figure 28, it can be seen that premium lapse rate (roughly around 4%) for the group-I class did not have as much fluctuation as the corresponding number lapse rate has. Even though there was a sharp increase in number lapse rate to 44.5% in 2005-06 there is no increase of such magnitude in premium lapse rate. One of the factors leading to this kind of observation may be the decrease in average premium lapsed per policy. The group-II companies showed a sharp rise in premium lapse rate in 2004-05, which shows lapsation of more of high premium policies.

3.5.7 Pensions

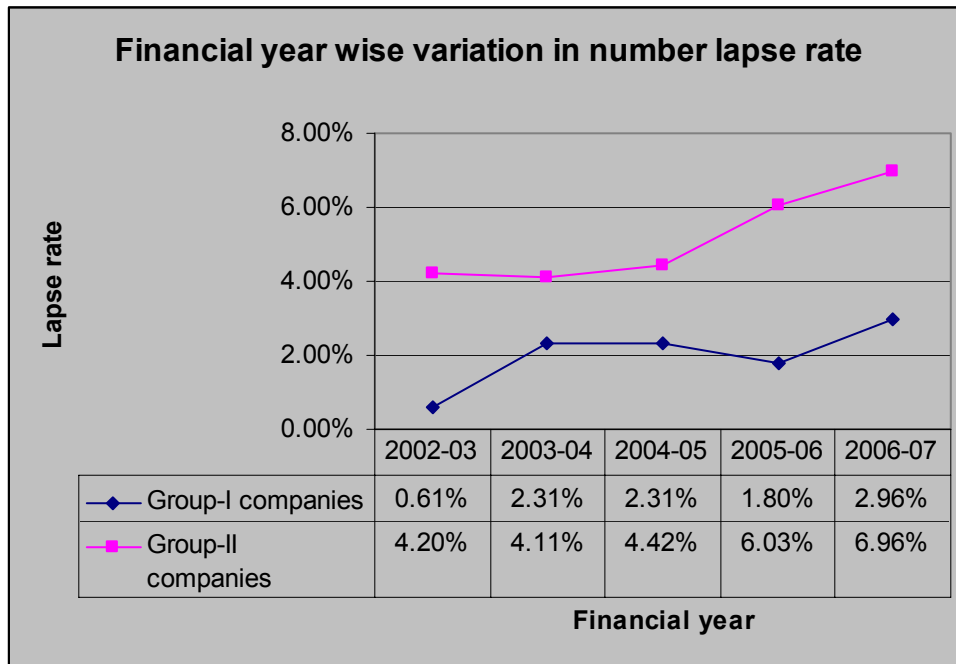


Figure 29

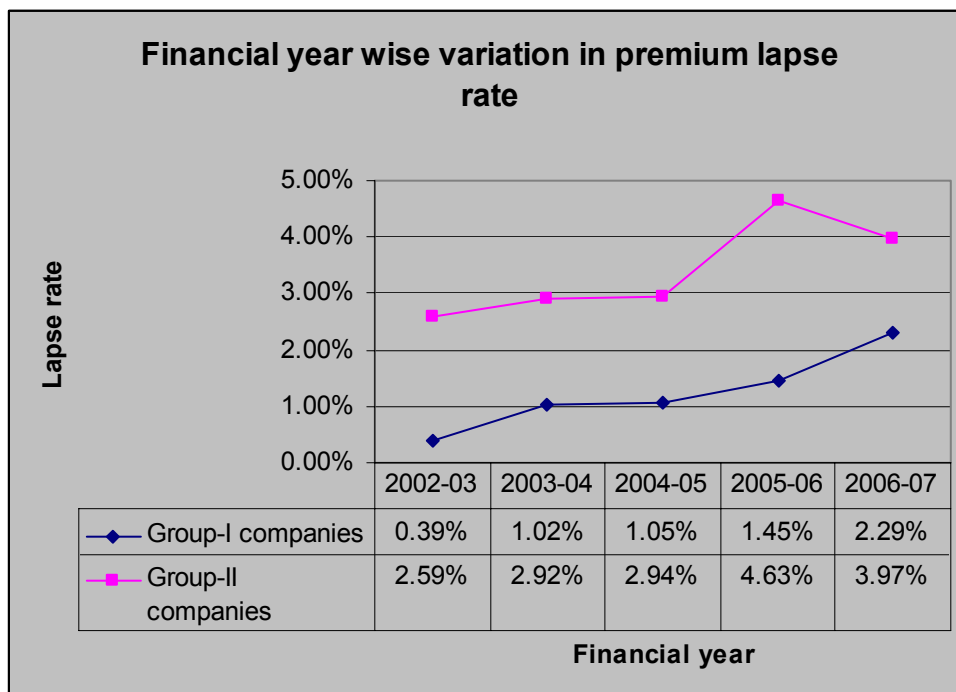


Figure 30

Pension product seems to have the least lapse rate compared to other type of products.

* * * * *

CHAPTER – IV

Analysis with Single factor data

4.1 This chapter and the next are concerned with the application of statistical methods for identification of factors which influence the lapse rates. No standard statistical package was available in this context and the analysis had to be carried out using the facility of ANOVA in Microsoft excel spreadsheet program.

4.2 ANOVA principles were applied to find out significant single factors in the current chapter and significant two factor combinations (in the next chapter) and to measure the level of significance. All factors (or combination of two factors) found significant will need to be incorporated into the theoretical model to be developed in future. The order in which the significant factors contribute to the variation was judged from the proportions of variation in each ANOVA. The response coefficients were tested for their statistical significance and those factors which were found to be significant are put in the order of importance, as per the standard established practice. However, it is believed that this is a reasonable first step towards more detailed analyses in future years.

4.3 As mentioned earlier in Chapter-I, to mitigate the heterogeneity resulted from non-availability of data resulted from recent entry of some of the companies into the industry, it was decided to base industry wise calculations based on single factor/two-factor data using the **data for the period from 2004-05 to 2006-07**. The detailed procedure of application ANOVA principles is given in **Annexure- 5**.

4.3.1 Summary of data submitted is given below.

Single factor	Number of policies lapsed(in crore life years)	Exposed to risk(in crore life-years)	Ratio of (2) to (3)	Premium lapsed(in Rs. crore)	Premium exposed to risk(in Rs. crore)	Ratio of (5) to (6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age group	3.493	48.379	7.22%	14984.377	236266.814	6.34%
Duration elapsed	3.538	48.475	7.30%	15352.503	237464.211	6.47%
Premium paying term	3.502	48.467	7.23%	13572.993	229387.548	5.92%
Type of underwriting	3.603	48.594	15.39%	15184.130	239708.082	10.74%
Type of agency	0.238	1.546	15.39%	3114.990	29003.631	10.74%
Sex	3.573	47.976	7.37%	17874.648	278691.289	6.36%
Rural/Urban break up	3.557	48.237	7.22%	14902.833	234279.387	6.34%

4.3.2 The application of ANOVA led to the following results. Details of variations and the F-test values are shown in the **Annexure-6**.

4.3.3. With respect to number of policies and premium lapsed, the following were the factors in the decreasing level of significance.

Factors influencing the lapse rates, in the decreasing level of significance						
Number	Age at entry	Mode	Duration	Policy type	Type of underwriting	Type of Agency
Premium	Age at entry	Duration	Mode	Policy type	Type of underwriting	Premium paying term
Both Number & Premium	Age at entry	Duration	Mode	Policy type	Type of underwriting	

The effect of the above factors on lapse rate was as following:

1. Factor: Age group at entry

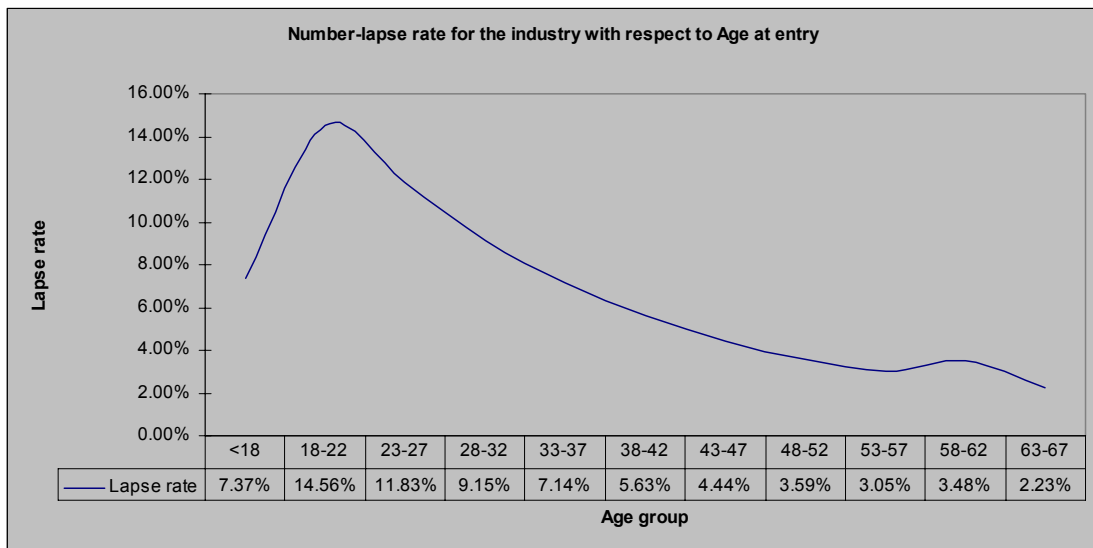


Figure 31

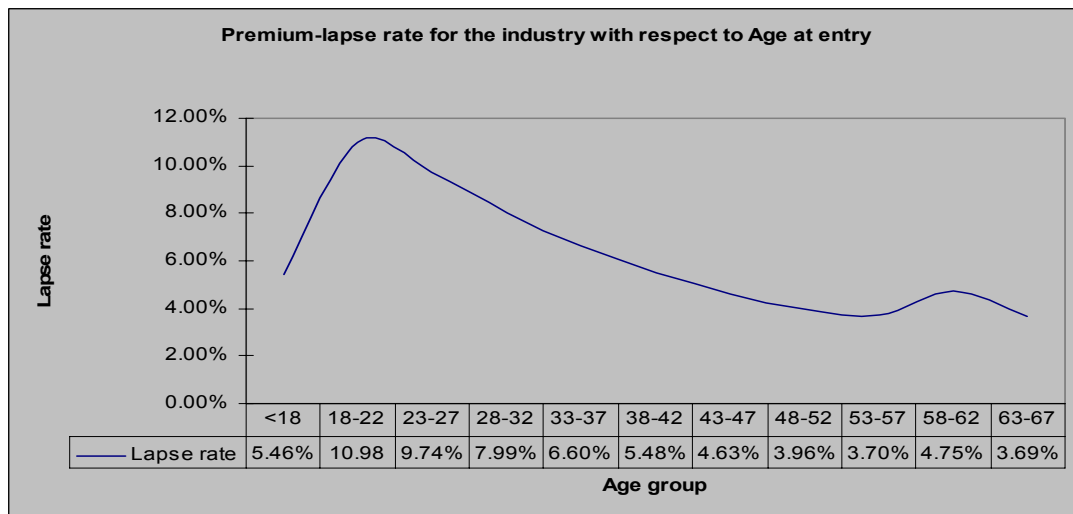


Figure 32

From the figures 31 & 32 the following can be observed

At ages less than 18 years, the premiums are generally paid by the parents/guardians on their children's policies. Hence the lapse rates tended to be low at very young ages.

Lapse rates were observed to increase from age group of less than 18 years till 18-23. Inclination towards alternative risky investment channels yielding high returns and lack of continuity in earnings might be the contributing factors for high rates of lapse at younger ages.

Lapse rate for the industry showed a decreasing trend from the age range 18-22 to age range 53-57. Increased levels of awareness of need for insurance between the ages 40 and 60 could have resulted in decreasing rates of lapse. Also, as need for insurance will be felt more as the age advances lapse rates tended to decrease with age.

There is a deviation in the lapse rate in the age range of 58-62, which may be random fluctuation or due to inability to continue the premium payments at older ages.

It is interesting to note that both the number of policies lapsed and premium lapsed revealed the same lapse behaviour.

2. Factor: Duration elapsed since inception

Duration of 'n' indicates n number of completed years since inception of the policy. Duration 0 indicates first policy year, duration 1 indicates 2nd policy year and so on.

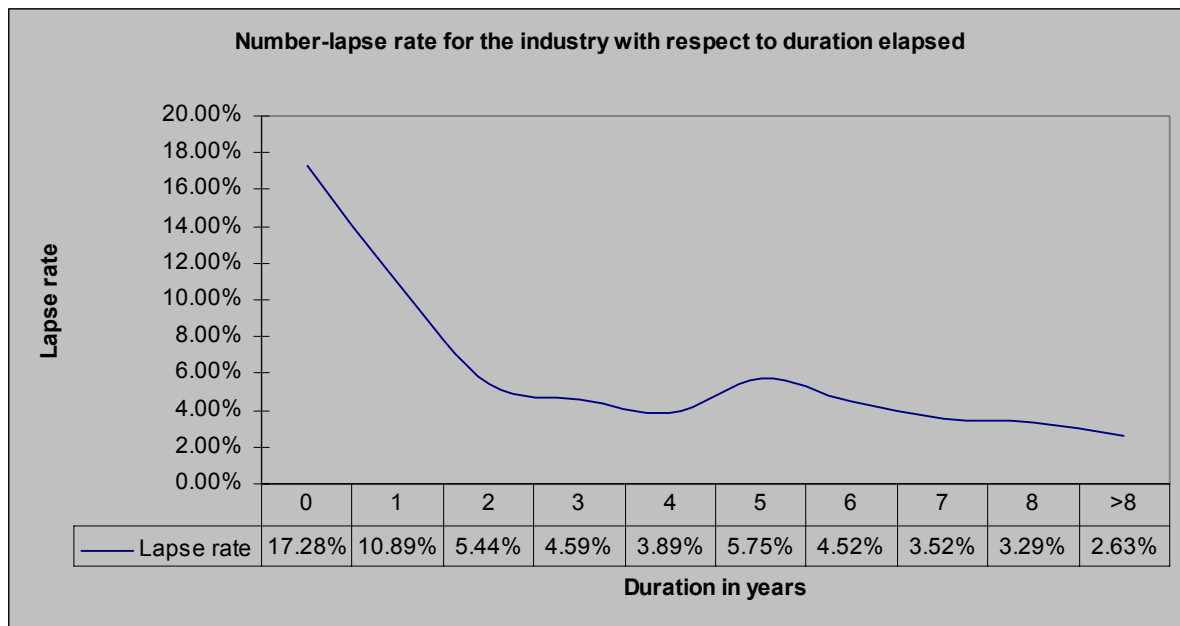


Figure 33

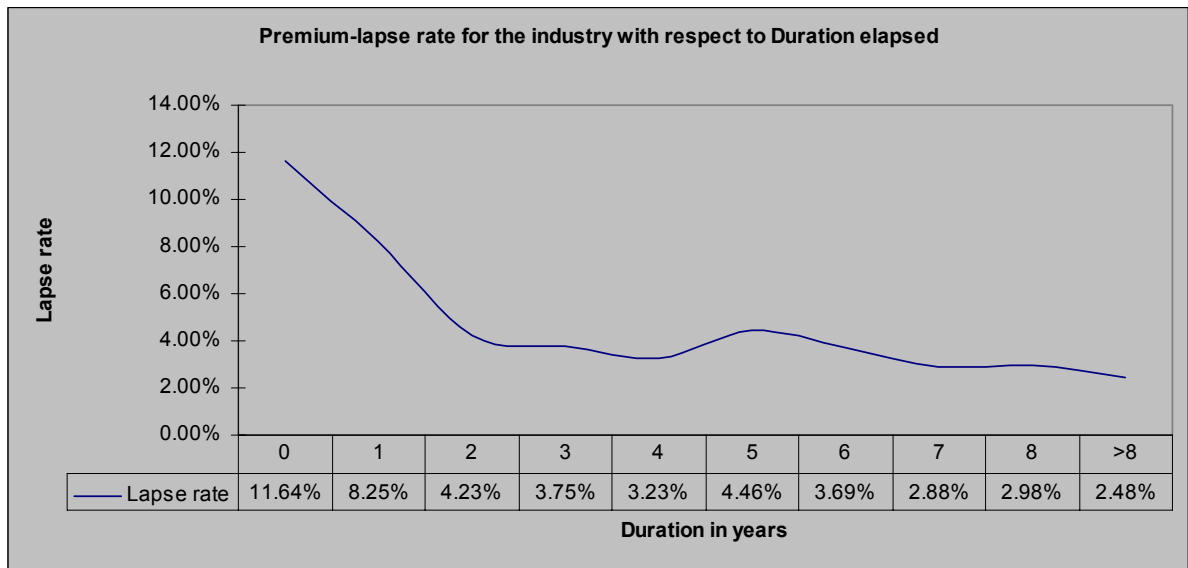


Figure 34

From the figures 33 & 34 the following can be observed

Trends in lapse rate with respect to number were observed to be similar to those with respect to premium lapsed with premium lapse rate being lower than the number lapse rate at all durations which might be due to higher lapses at lower premium range policies. Lapse rates were observed to be decreasing with duration elapsed with a deviation around duration of 5 years.

The high initial lapse rates could be due to forced sales by the intermediaries or sales force not giving enough explanation of the policy conditions and benefits payable to the policyholder or lack of understanding of policy conditions by the policyholder at proposal stage. Majority of the products acquire surrender/paid-up value after three to five years of policy duration which might be another causal factor for increase in lapse rate between four to six years. Most of the policies (around 53% of the policies commenced) tend to be continued in the durations of 8 and above.

**This observation was also found in the earlier studies (Sarma 1987, Limra International 2005, Renshaw and Haberman).*

3. Factor: Mode

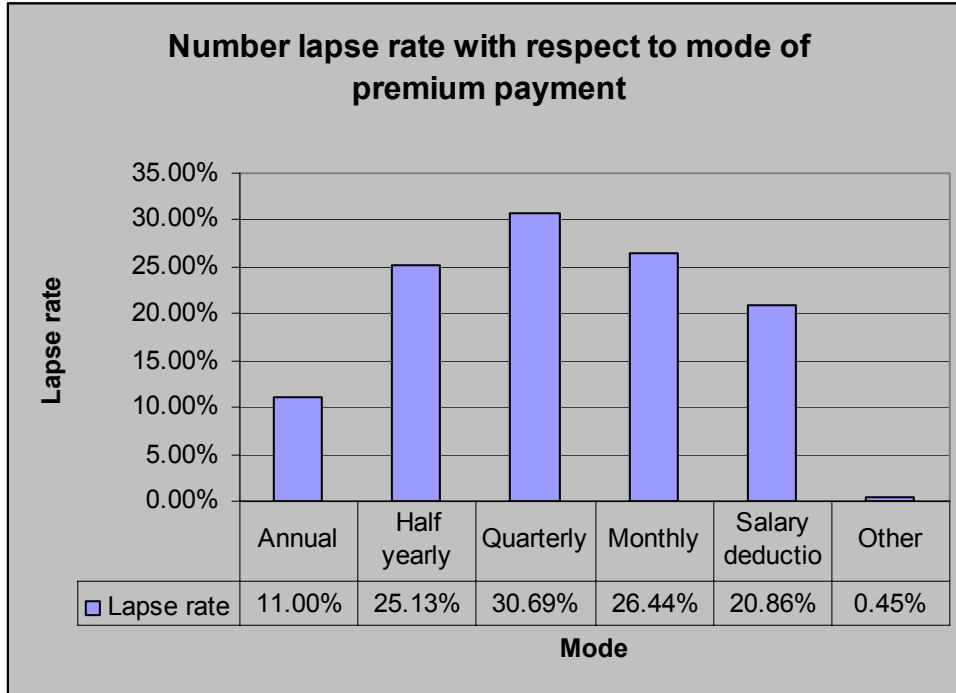


Figure 35

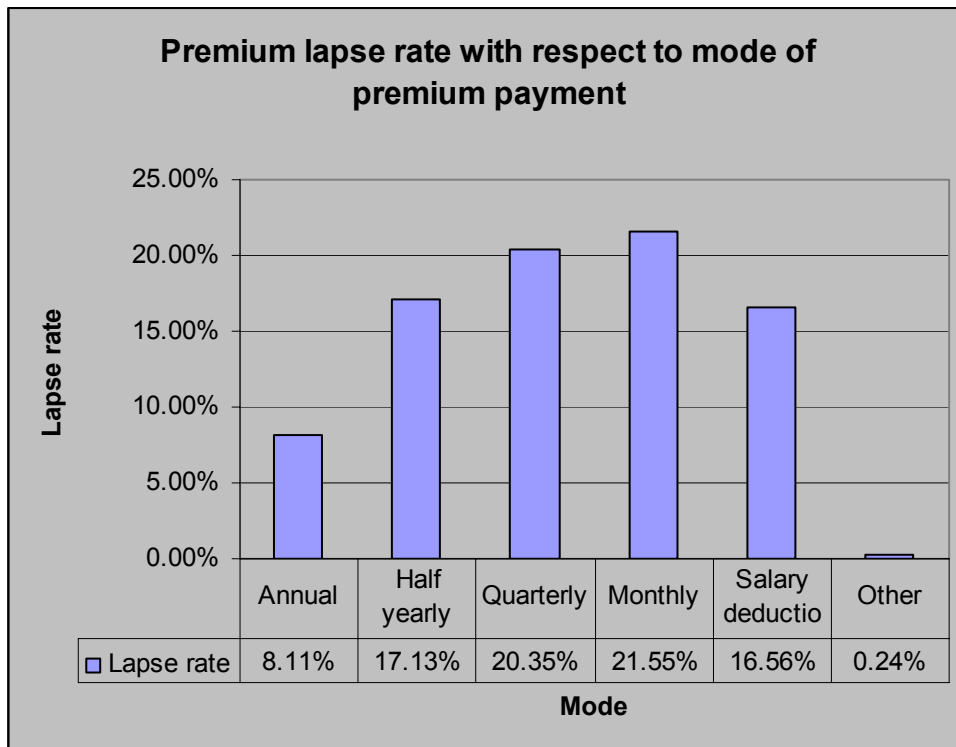


Figure 36

Mode of Premium payment was found to be significant both in Single factor and Two-factor analyses.

Lapse rates with respect to number were observed to increase with increase in frequency of the premium payment up to quarterly mode and there is a decrease in lapse rate for monthly mode. Lapse rate with respect to premium was observed to increase with increase in frequency of the premium payment up to monthly mode.

The possible causes for increase in lapse rates with increase in frequency of premium payment could be i) reduction in grace period for higher frequent modes ii) it will be more expensive to the company to send the premium reminders to the policyholders every month/quarter than for less frequent modes, also there will be a higher administrative costs associated with higher frequency modes. iii) Discounts (Mode rebates) available on less frequent modes premium payments could have also helped to the trends observed. There is more scope for a policy with more frequent mode of premium payment to lapse than with less frequent mode.(e.g. once premium is paid annual premium policy can not lapse with in that policy year unless surrendered which is not the case with a monthly mode policy.

Lapse rate in Salary deduction mode was less than that under Monthly mode which could be due to increased level of automation in premium payment as the employer directly deducts the premium from the salary and pays to the insurer. However, the lapse rate with respect to Salary-deduction mode largely depends on efficiency of the employer which varies between public and private sectors. Further levels of increased automation in case of Electronic transfer of premiums would have caused the lapse rates decreased for the mode 'Others'.

Trends lapse rate with respect to 'mode of premium payment' have been found similar with following earlier studies.

**This observation was also found in the earlier studies (Sarma 1987, Limra International 2005).*

4. Factor: Type of policy

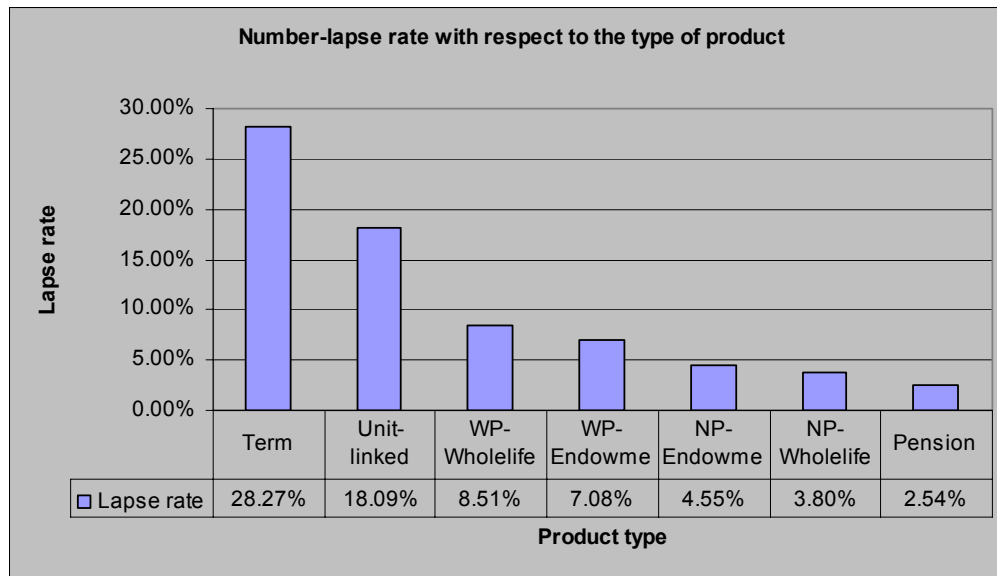


Figure 37

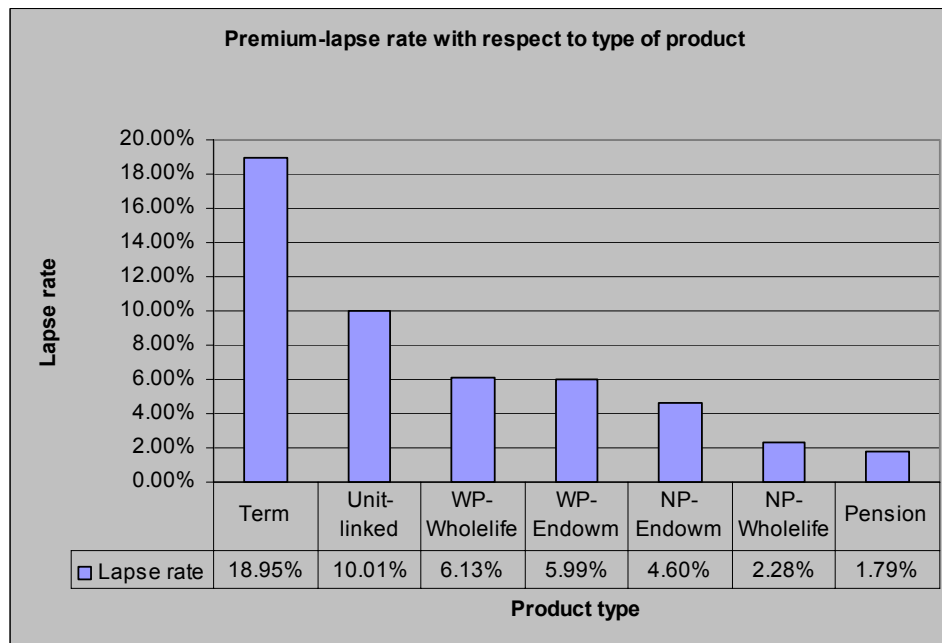


Figure 38

From the figures 37 & 38, it can be observed that the trends in lapse rate with respect to both number and premium were almost similar to each other. With-profit policies show higher rates of lapse when compared to their non-profit counter parts for Endowment and whole life policies. Whole life products showed higher lapse rate than endowment products for with profit policies.

Term assurance policies showed the highest rate of lapse with respect to both number and premium lapsed. Pension policies were observed to show the least lapse rates among the all.

5. Factor: Type of Underwriting

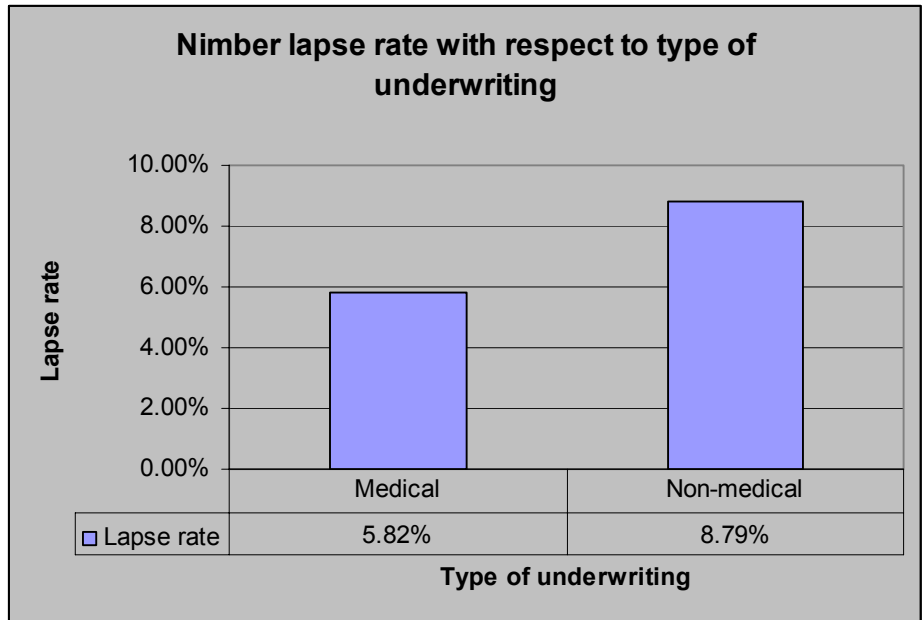


Figure 39

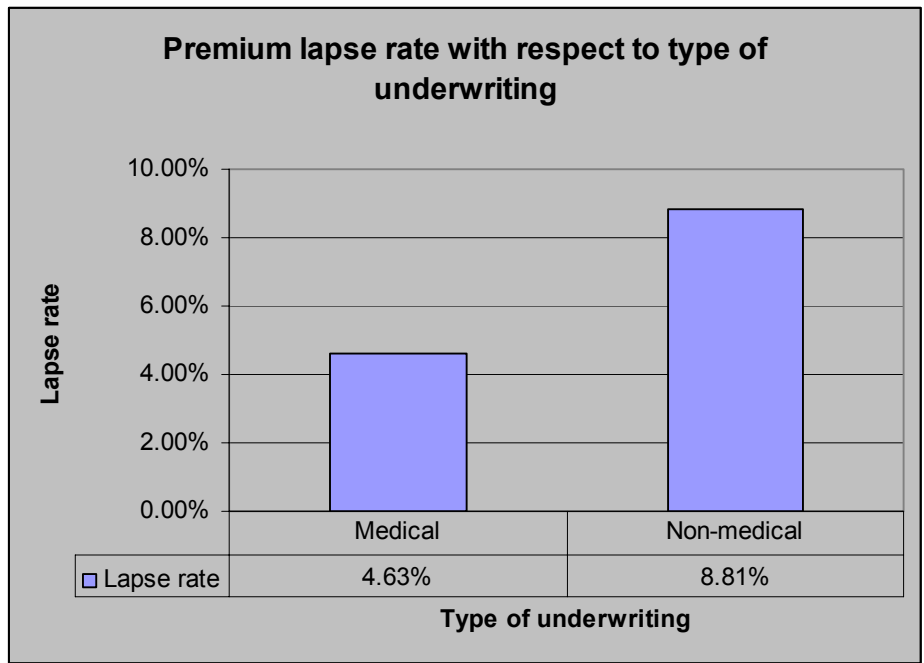


Figure 40

Lapse rates for Non-Medical policies were observed to be higher than Medical policies. In general, policies under medical category are taken by people opting for higher sums assured and those with health consciousness whose commitment to persist the policy contracts can be expected to be high.

4.3.4 The factors i) Premium paying term ii) Premium range iii) sex and iv) Rural/Urban were *not* found to be significant in affecting the number of policies lapsed.

4.3.5 The factors i) Type of Agency ii) sex and iii) Rural/Urban were *not* found to be significant in affecting the premium lapsed.

However, variations of the lapse rate with respect the above factors are as following.

6. Factor: Premium term

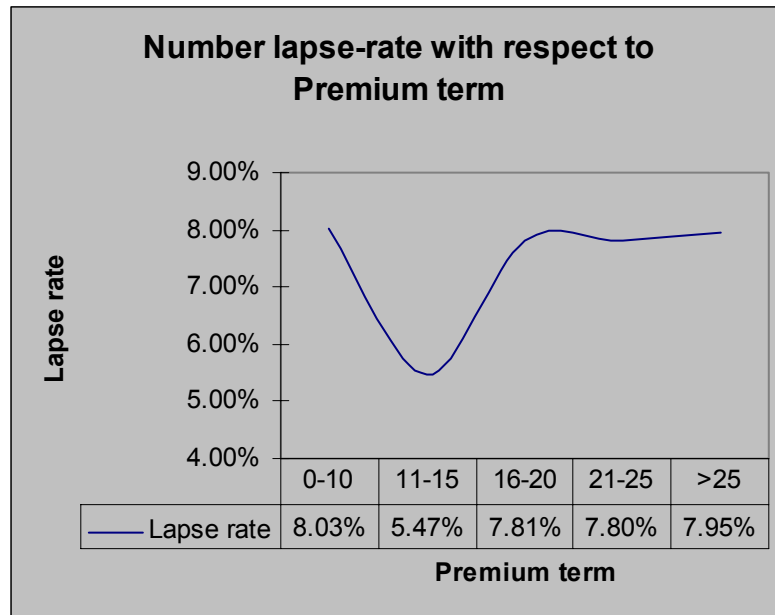


Figure 41

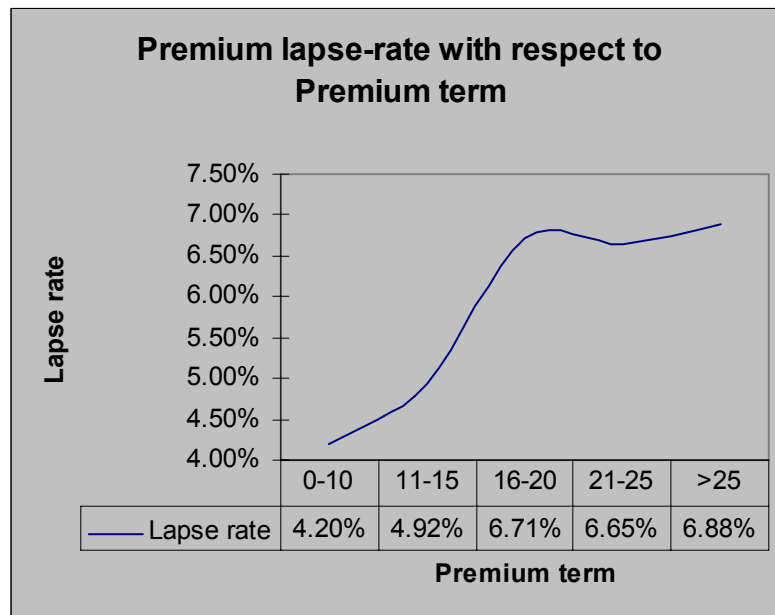


Figure 42

Premium term was found not much significant in influencing the lapse rate with respect to number of policies. However, from the figures 41 & 42 , the rates with respect to number of policies were observed to be lower(around 5.5%) in the range of 11 to 15 years of premium term compared to those of other ranges(around 8%) i.e. high at very low and very high premium ranges.

The lapse rate with respect number showed an increasing trend from the range of 11-15 years to the range of 21-25 years thereafter remained constant more or less. However, the higher lapse rate at premium terms greater than 15 might be due to lack of ability to afford to pay premiums continuously for a longer term. At very low premium terms, the amount of premium would be high which could have caused the higher rate of lapse.

Premium term was found to be significant in influencing the lapse rate with respect to premium lapsed. Lapse rate with respect to premium lapsed is observed to rise continuously with the premium term. However the premium lapse rate was lower than the lapse rate with respect number at all premium terms. This might be due to higher lapses at lower premium ranges.

7. Factor: Premium range

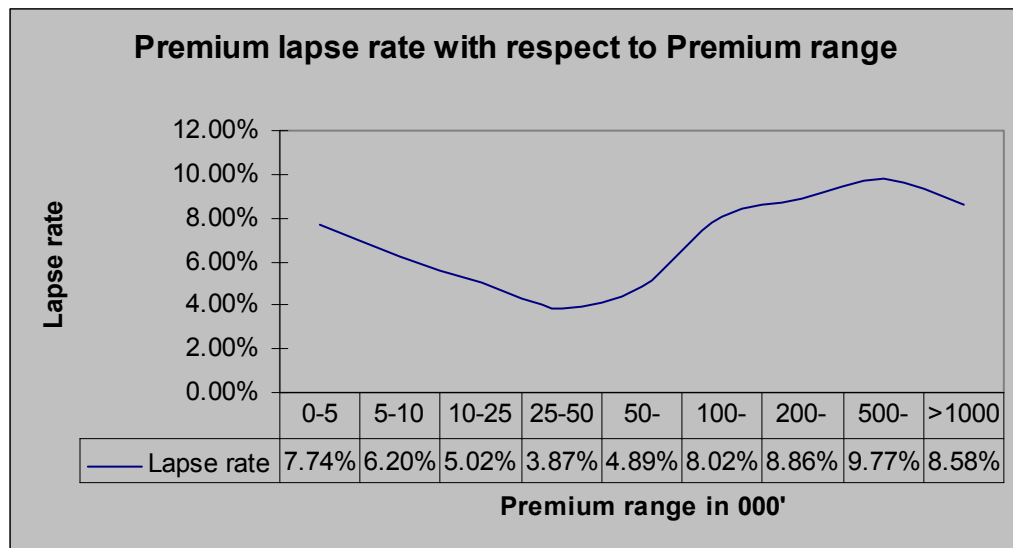


Figure 43

At high levels of premium lapse rates observed are very high which might be due to large premiums becoming a burden if income levels fluctuate over time or increase of choice of investment for financially sound section of the society.

At very low premium ranges, comparably high lapse rate might be due to inability to continue premium payment by lower income groups of society.

8. Factor: Agency Type

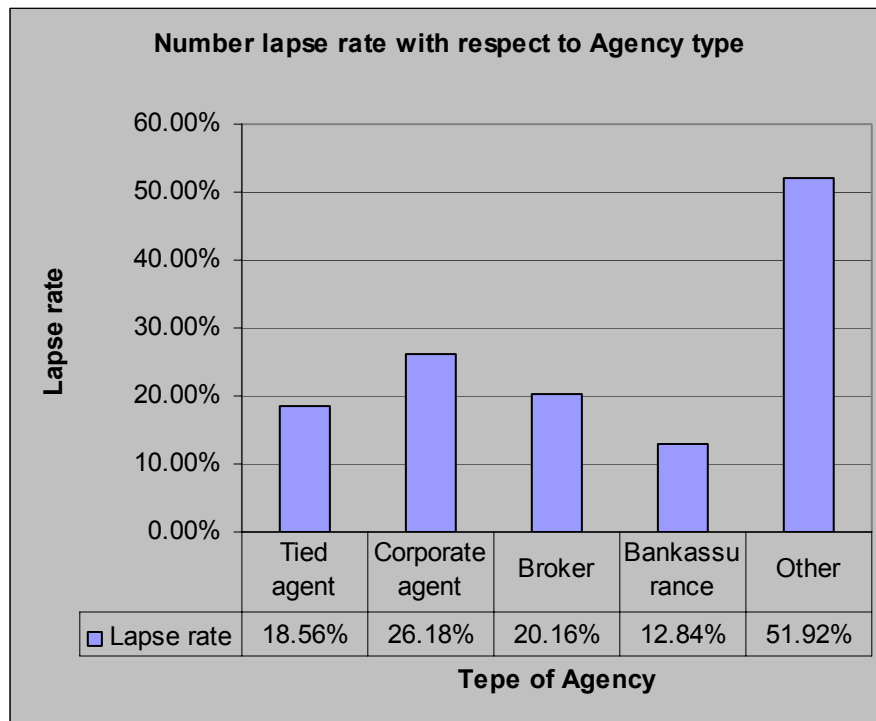


Figure 44

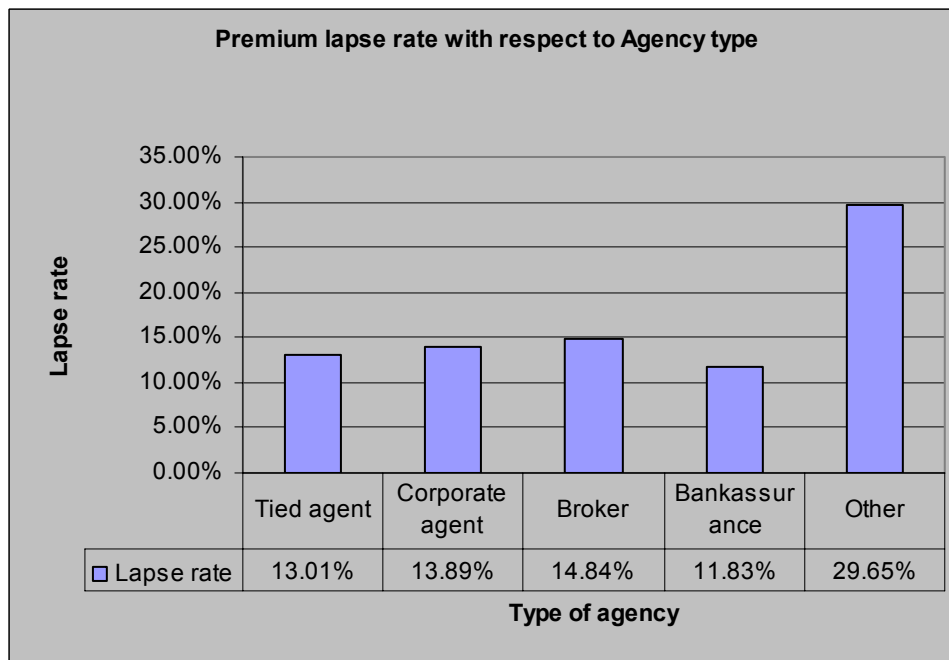


Figure 45

Agency type was found least significant in both two-factor and single factor analysis and also found not significant with respect to premium lapsed. However, from the figures 44 & 45, lapse rate for the channel 'Other' (which constituted mostly the referral arrangements direct

marketing Micro insurance/rural agents) were observed to be higher than those of other common distribution channels.

Among the common distribution channels, the number lapse rate was observed to be the highest for Corporate Agent followed by Brokers, Tied Agents and Bancassurance.

With respect to the premium lapsed, the lapse rate varied from 12% to 15% for the common distribution channels.

9. Factor: Sex

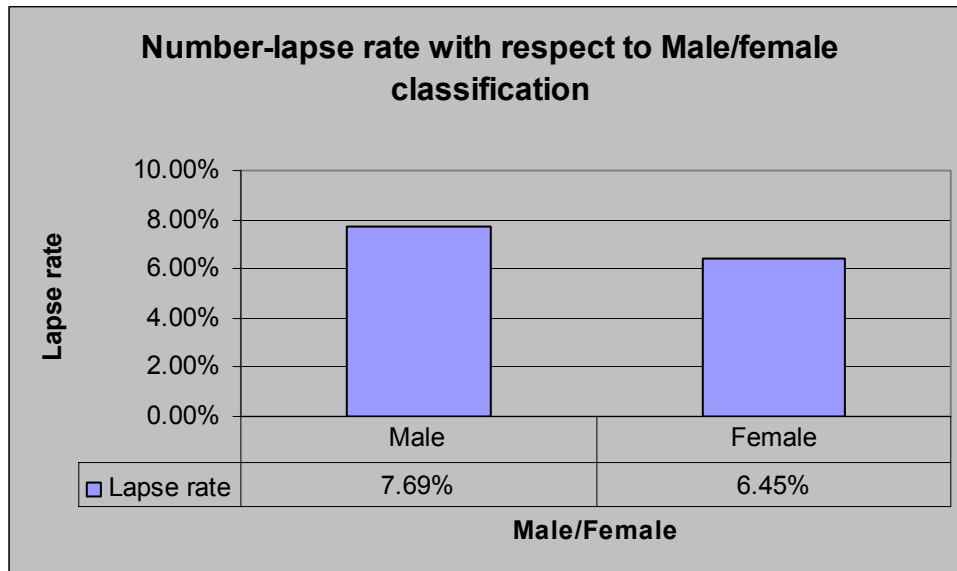


Figure 46

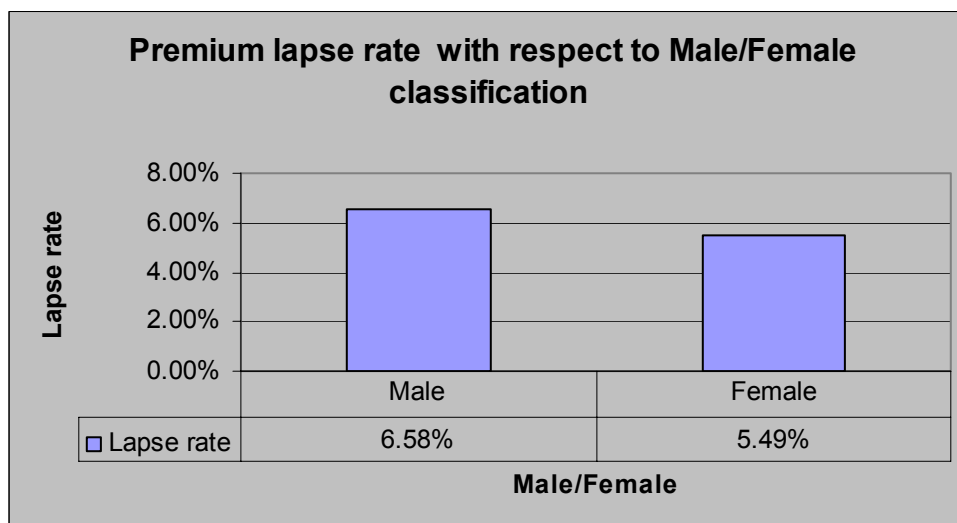


Figure 47

This factor was not found significant in affecting the lapse rates. However, male lives show a little higher lapse rate than female lives.

10. Factor: Rural/Urban

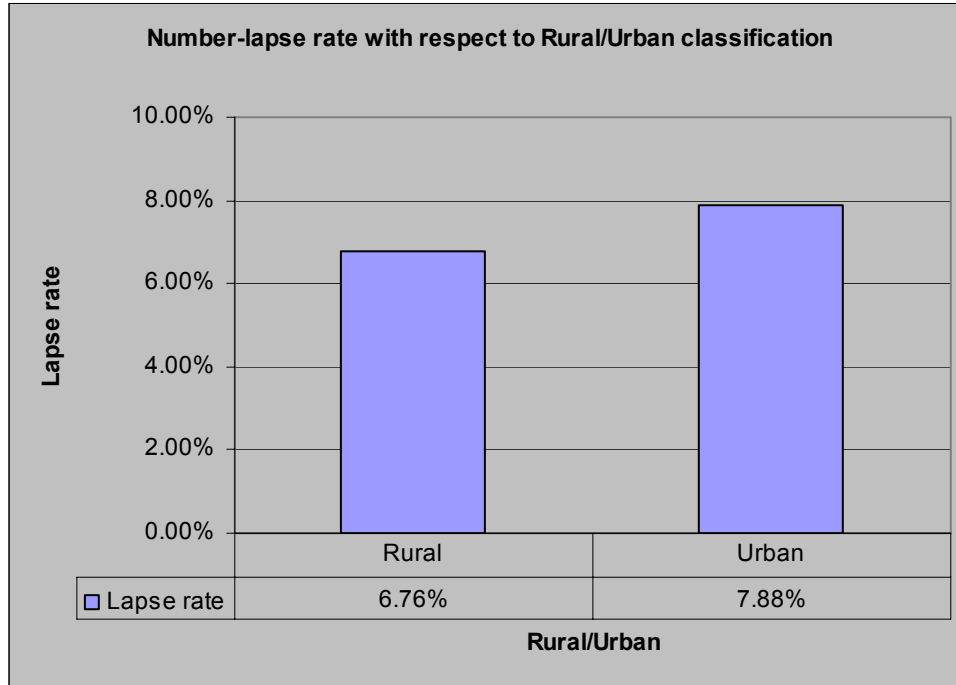


Figure 48

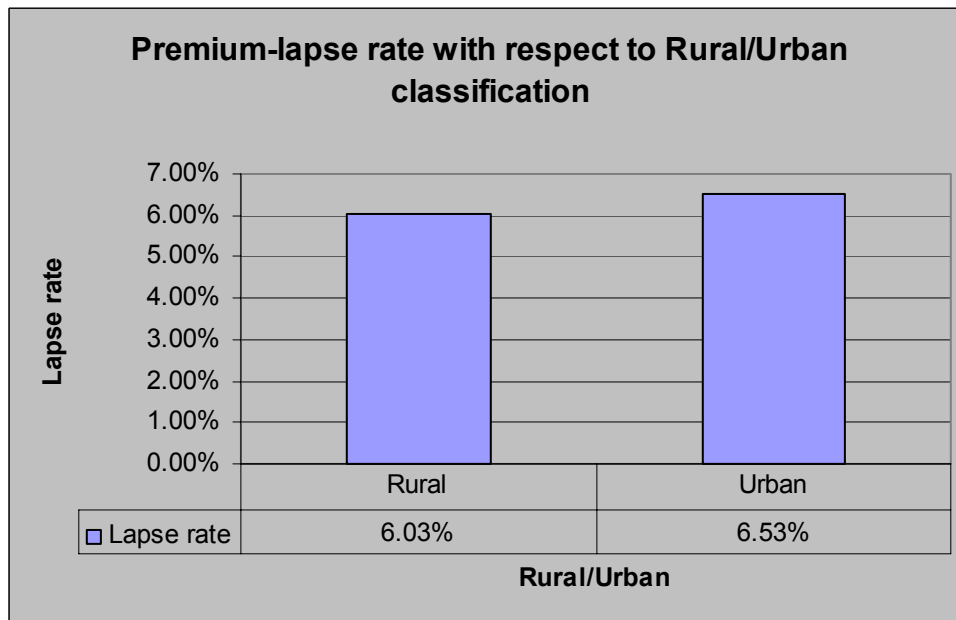


Figure 49

Rural/Urban classification was not found significant in affecting the lapse rates. However, urban lapse rate was observed to be higher than rural lapse rate with respect to both number and premium lapsed.

CHAPTER – V

Analysis with Two-factor data

5.1 Identification of significant factors affecting the Lapse rates for the industry using Two-Factor data of the period 2004-05 to 2006-07.

The application of ANOVA led to the following results. Details of variations and the F-test values are shown in the **Annexure-7**.

By applying ANOVA principles to two-factor data F_1 & F_2 , if we find the factor F_1 significant in combination with the factor F_2 , then this indicates – for a given value of factor F_2 , on classification of the lapse rates according to the factor F_1 , the lapse rates vary significantly among various F_1 groups.

- 1. Duration** was found to be significant in *five out of five* comparisons.
The five comparisons were with i) Age at entry ii) Original premium paying term iii) Premium range iv) Agency type and v) policy type
- 2. Mode** was *significant in two out of two* comparisons.
The two comparisons were with i) Agency ii) Premium range
- 3. Age at entry** was found to be significant in *both the comparisons* it was tested.
The two comparisons were with i) Age at entry ii) Premium range
- 4. Policy type** was *significant in two out of two* comparisons.
The two comparisons were with i) Agency ii) Duration
- 5. Premium Range** was found to be significant in *three comparisons out of four*.
The four comparisons were with i) Age at entry ii) Mode iii) Duration iv) Agency type.
Out of these, **Premium Range** was found to be significant in combination with i) Age at entry ii) Mode iii) Agency type. It was not found significant in combination with Duration.
- 6. Agency type** was found to be significant in *only one combination out of five combinations* with other factors. The five comparisons were with i) Age at entry ii) Original premium paying term iii) Premium range iv) Duration and v) policy type

Out of these, **Agency type** was found to be significant only in combination with 'duration'.
- 7. Premium term** was *not* found to be significant in *both the comparisons* it was tested.
The two comparisons were with i) Duration ii) Agency type

In the order of level of significance, the factors may be placed as follows i) Duration ii) Age at entry iii) Mode iv) Policy type v) Premium range.

5.2 Effect of combination of factors on the trends in Industry Lapse rate

Using combined data for three years from 2004-05 to 2005-06 the industry trends observed for each of the combination of factors were as following.

1. *Combination of factors: Age group and Duration*

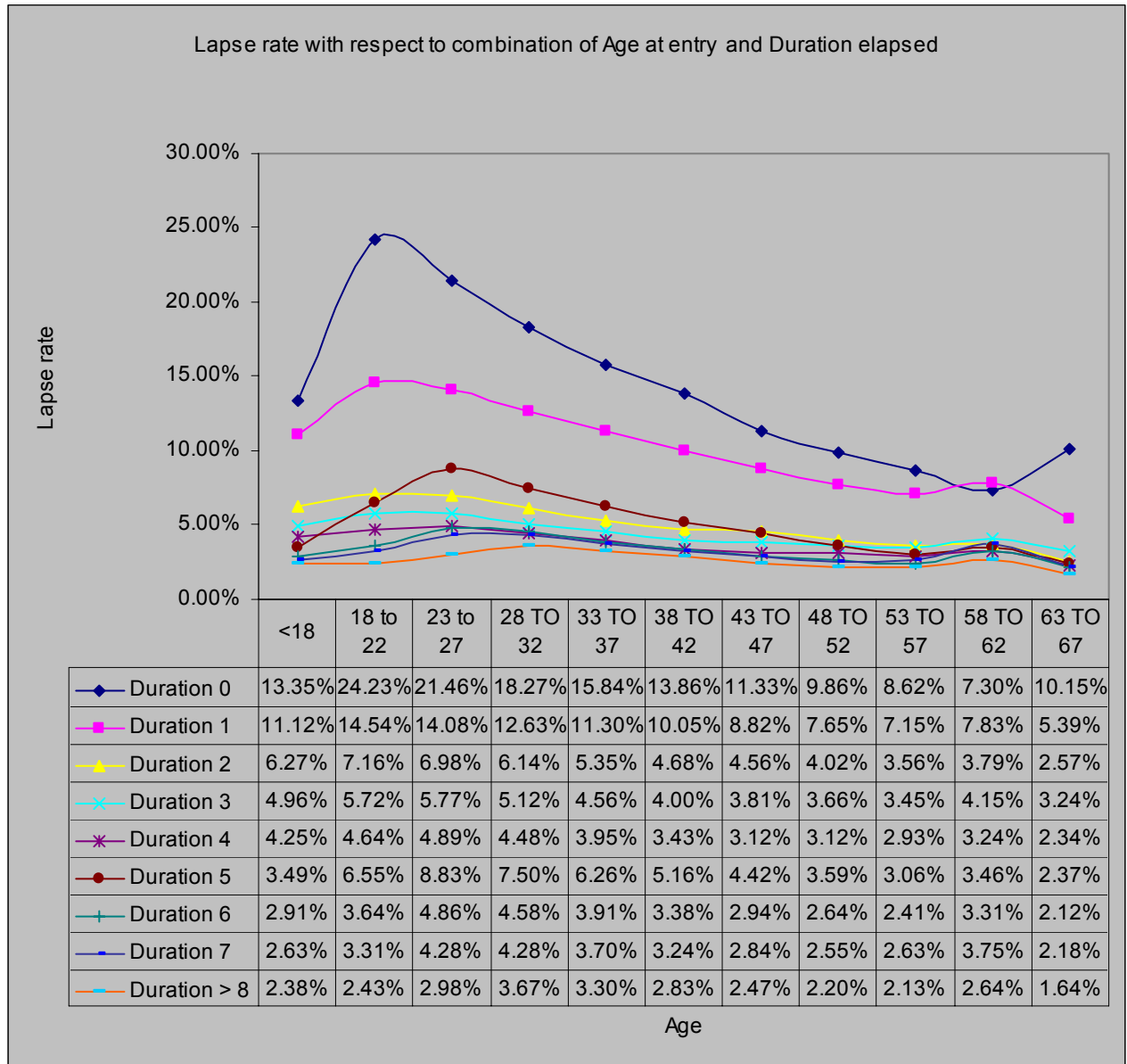


Figure 50

For all age groups (except in the age band of 58-62) initial year lapse rates were the highest and the lapse rate started decreasing thereafter as the duration increases except for the duration 5 years where there was a slight increase in lapse rate which could be due to majority of the products acquiring surrender/paid-up value after three to five years of policy duration or a random fluctuation. From age around 55 the lapse rate had almost remained constant for durations 3-5 without many deviations in between. There was a deviation in the

lapse rate in the age range of 58-62 which may be random fluctuation or due to inability to continue the premium payments as at older ages.

At ages less than 18 years, the premiums will be paid by the elders on their children's policies. Hence the lapse rates tended to be low at very young ages. Lapse rates tend to increase from age 18 years till 23 for almost all durations. i) Savings element playing a dominating role, ii) lack of awareness of need for insurance iii) inclination towards alternative risky investment channels yielding high returns and iv) lack of continuity in earnings might be the contributing factors for high rates of lapse at younger ages.

Lapse rate for the industry showed a decreasing trend from the age range 18-22 to age range 53-57. Increased levels of awareness of need for insurance between the ages 40 and 60 could have resulted in decreasing rates of lapse. Also, as need for insurance will be felt more as the age advances lapse rates tended to decrease with age.

The trends observed under this combination are similar to those observed under single factor 'Age at entry' and 'Duration' at almost all points.

**This observation was also found in the earlier studies (Sarma 1987).*

2. Combination of factors: Duration and Premium paying term

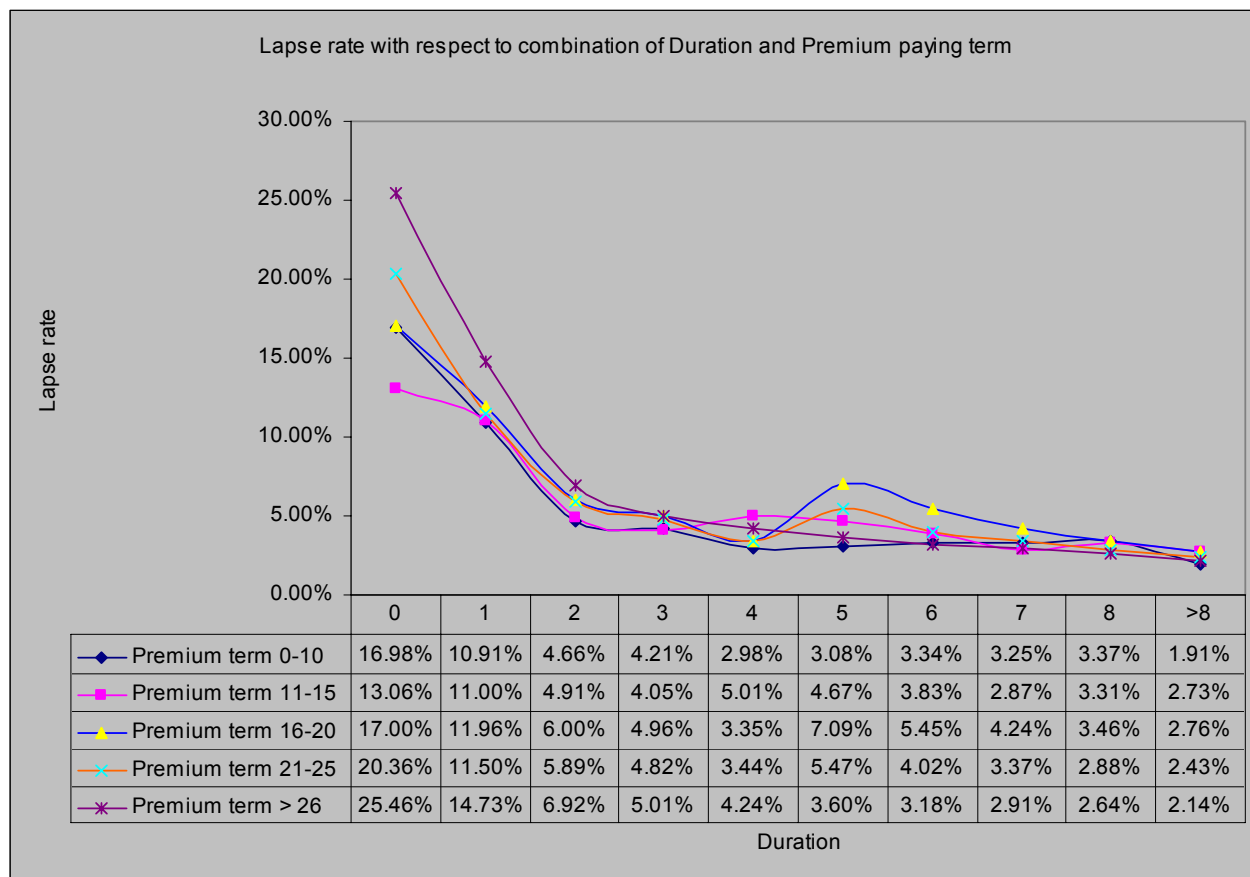


Figure 51

For durations 0-1 and 7-8 years, premium paying term of 11-15 years showed the lowest lapse rate. From duration 2-6 lapse rate was observed to be increasing with increase in premium paying term.

As ‘premium paying term’ was found not significant and duration being most significant the interaction is revealing more of the characteristics with respect to ‘duration’.

Up to duration of 4 years, Premium paying term of 26 and above showed higher lapse rate than Premium paying term of 21-25 years and converse is observed with respect to durations greater than 4 years. (One reason for “Premium term >26” showing higher lapses up to duration 4 could be forced selling of long term policies (lower premium) ; the FY lapses being significantly higher.)

For all the premium-paying terms lapse rates showed a decreasing trend from the inception up to the duration of three to four years and fluctuating thereafter. Industry trends with respect to the factor ‘Duration’ are reflected for all the premium terms.

3. Combination of factors: Premium range and Duration

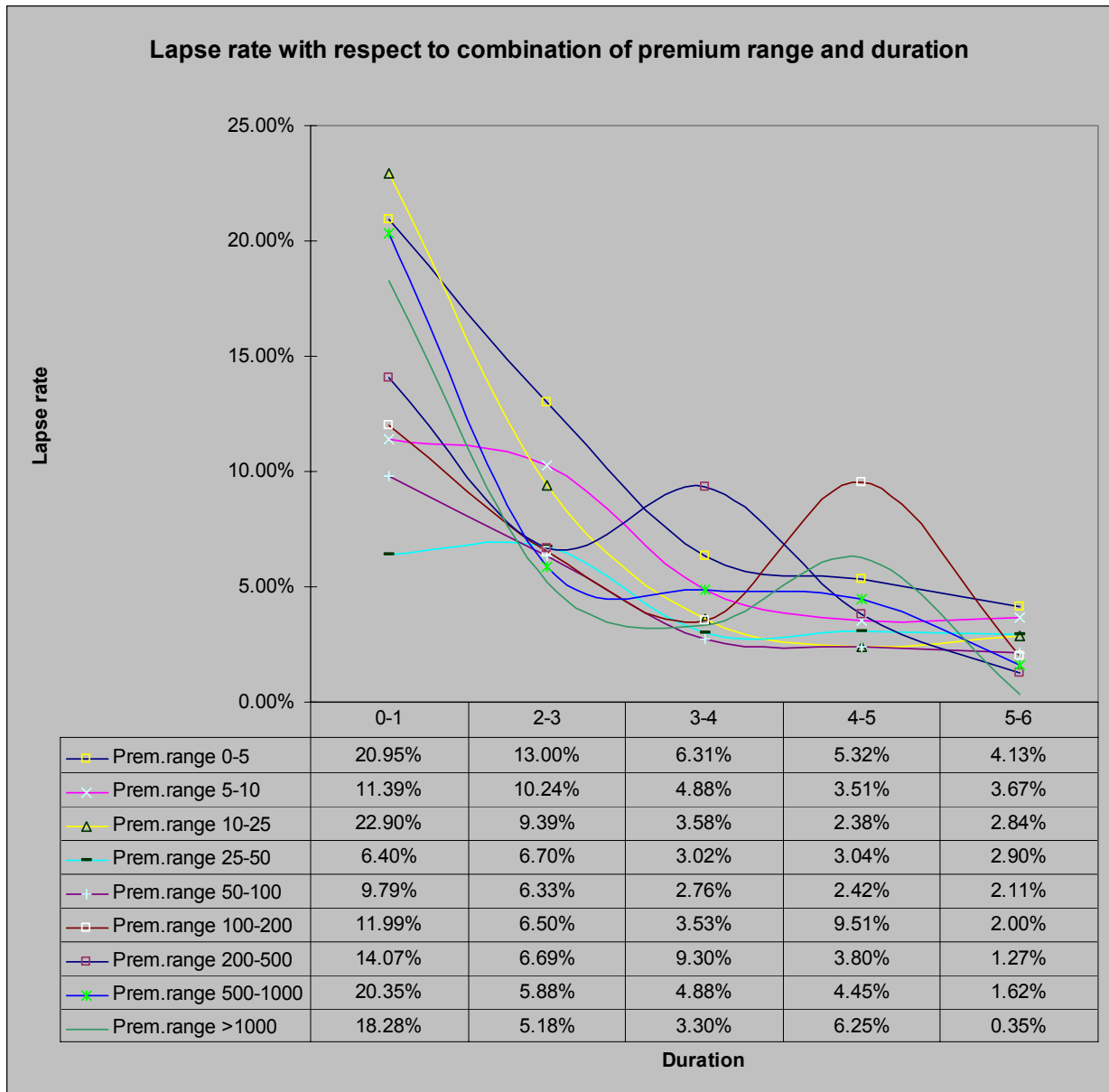


Figure 52

*** Premiums plotted are in 000's.

For premium ranges 0-5000, 5,000-10,000, 10,000-25,000, lapse rate was observed to be decreasing as the premium range increased for all durations from 2-6 years. First year lapse rate was highest for 10000-25000 range. First year lapse rate tended to be higher at very low and very high premium ranges.

For the same premium ranges mentioned above, between durations 2 to 4 years lapse rate is observed to be increasing up to duration 3 years and decreasing thereafter to duration 4 years.

Except for a few higher premium ranges for all premium-ranges the lapse rates show a decreasing trend with duration by and large. For higher premium ranges, the lapse rates show a sudden increase for durations of four to five years which may be due to the fact that most of the Endowment and whole life policies acquiring surrender/paid-up value after 3 to 5 years.

At high levels of premium lapse rates observed are very high which might be due to large premiums becoming a burden if income levels fluctuate over time or increase in choice of investment for financially sound section of the society.

At very low premium ranges, comparably high lapse rate might be due to the inability to continue premium payment by lower income groups of society.

4. Combination of factors: Duration and Agent type

Data for this combination of factors has not been received for major portion of the industry business.

With the available data the following analysis may be made.

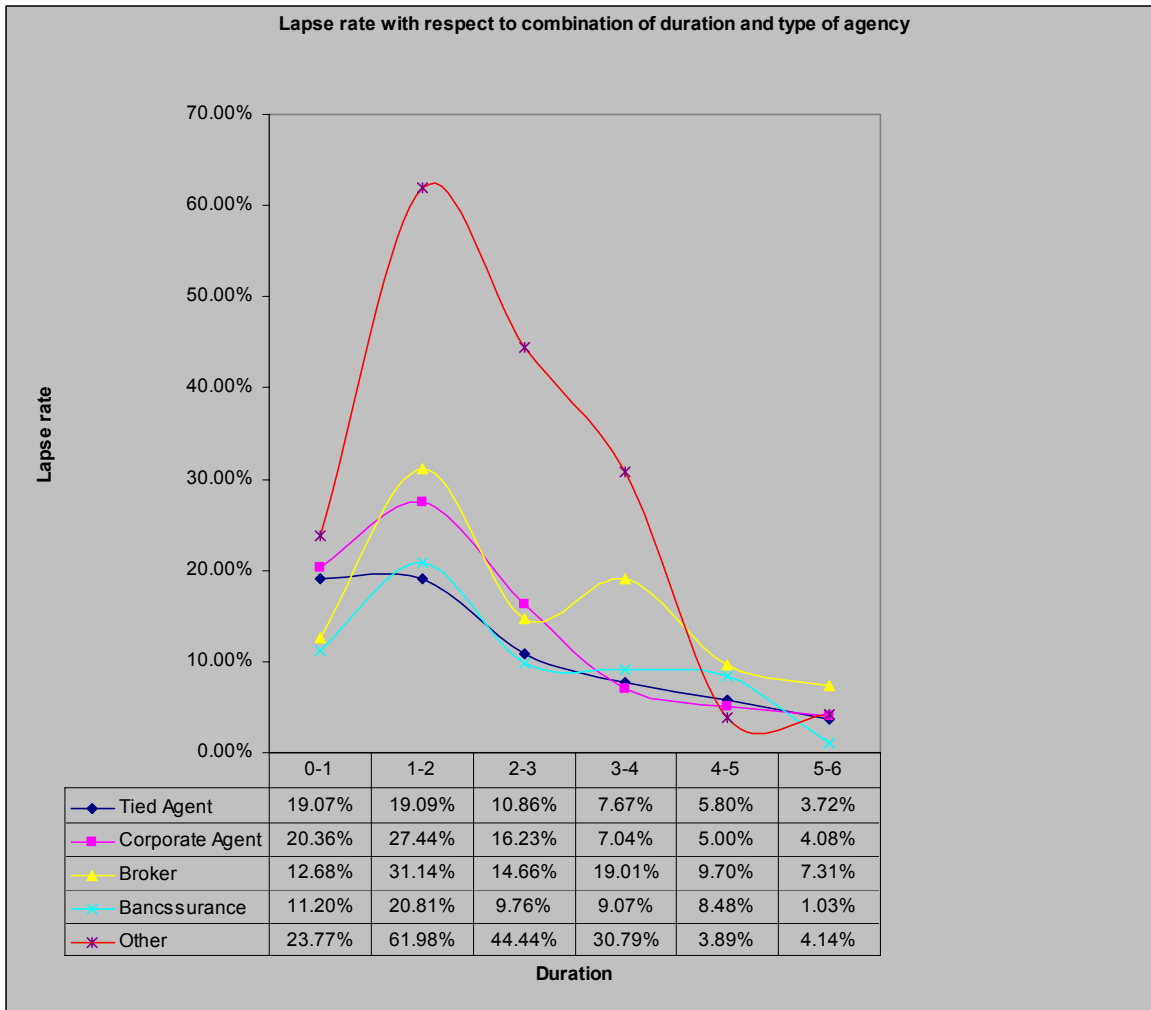


Figure 53

Lapse rate with respect various distribution channels appeared to be fluctuating.

Lapse rate for the Tied Agents appeared to be decreasing with duration elapsed since inception.

For other common distribution channels, the decrease in lapse rate with duration is observed from duration of 1 year onwards.

Although lapse levels for ‘Bancassurance’ were low, it is to be remembered that volume of data for these policies was low and only in future years meaningful conclusions can be drawn.

5. Combination of factors: Duration and Type of policy

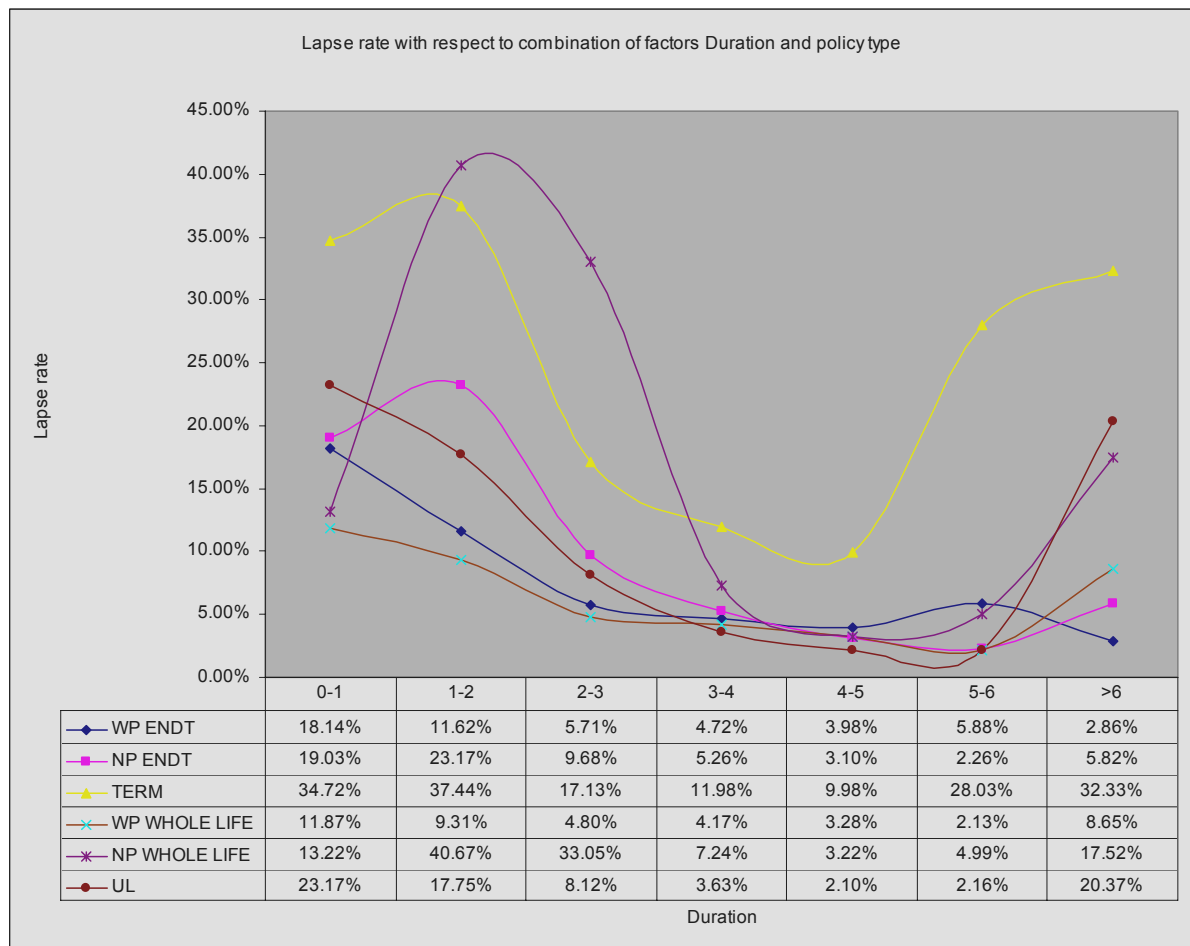


Figure 54

Lapse rate for with-profit endowment, with-profit whole-life and Unit Linked policies tended to decrease continuously with increase in duration up to 3-4 years since inception and fluctuating thereafter. Except for with-profit endowment plans, all other policy types show a sudden increase in lapse rate around 5-6 years. (Increase in lapse rate for Term plan for duration “6” and “7 and above” is difficult to be explained.)

Lapse rates for non-profit policies are observed to start decreasing after 1-2 years from inception and continue to decrease up to 4-5 years with increasing trend thereafter. For most durations, non-profit policies showed higher rates of lapse when compared to their with-profit counterparts for endowment and whole life policies.

Term assurance policies showed the highest rate of lapse in the initial years after inception with a sudden increase in the lapse rate in the duration of 5-6 years.

Trend in lapse rate for whole life policies as per Persistency Study by Limra International(2005) page 14 are similar to that of with-profit whole life of present study up to duration of 6 years. Thereafter, an increasing trend is observed with the present study and decreasing trend with the Limra study.

Trends in lapse rate of Term assurance policies with respect to duration elapsed have been found similar in both the studies.

As per the Statistical analysis of Life insurance lapses(1986) by A.E Renshaw and S.Haberman page 473, non-profit policies showed higher lapse rate than with profit policies for all durations where as current study shows this trend up to duration elapsed of four years. Also as per the Statistical analysis by A.E Renshaw and S.Haberman, non-profit whole life policies maintained a decreasing trend of lapses with increasing duration where as per the current study the policies showed such trend from durations of 2 years to 6 years and opposite trend for durations 0-2 years.

6. Combination of factors: Premium paying term and Type of Agency

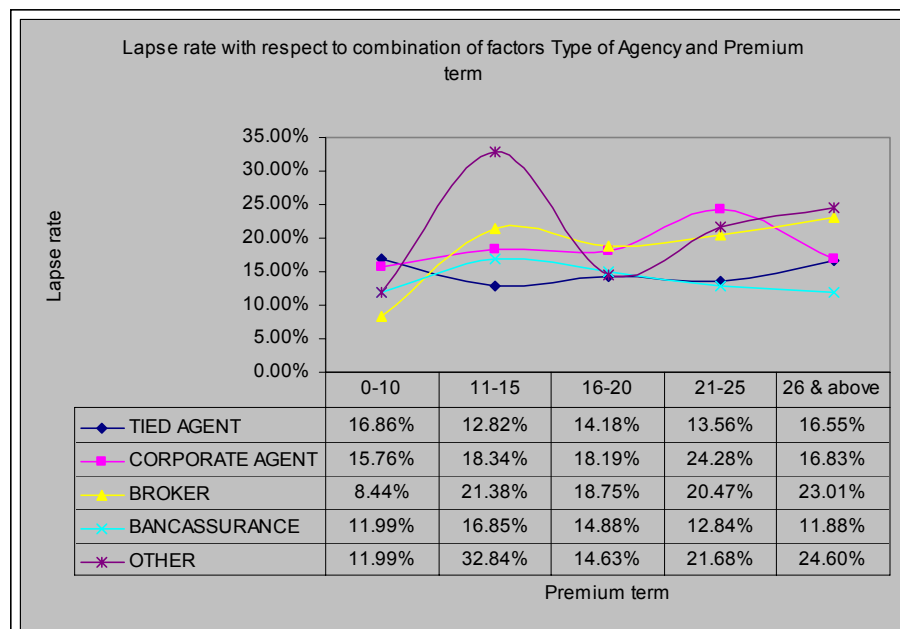


Figure 55

For Tied Agency, lapse rates are observed to decrease till the premium term ranging 11-15 years and increase slowly thereafter with minor fluctuations in between.

Under Bancassurance, lapse rates are observed to increase till the premium term ranging 11-15 years and decreased slowly thereafter.

Under Corporate Agency the lapse rates are observed to increase slowly till the premium term ranging 21-25 years and decrease from then.

For 'Other' (which constituted mostly the referral arrangements, direct marketing, and Micro insurance/rural agents) channels lapse rates show a big peak at the premium term 11-15 years with fluctuations thereafter.

For Brokers, lapse rates are observed to increase till the premium term ranging 11-15 years and thereafter there is a slower increase in lapse rate with premium paying term.

7. Combination of factors: Premium range and Agency

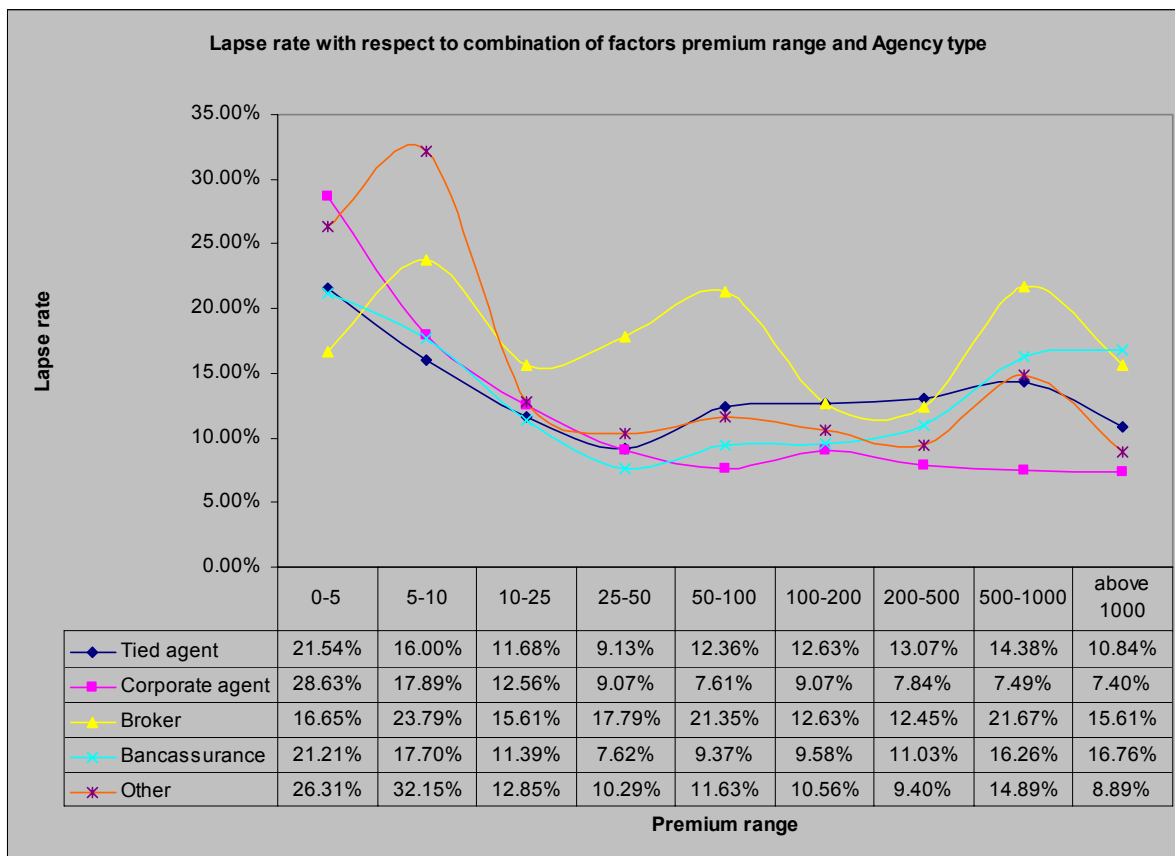


Figure 56

For tied agency and bancassurance the lapse rates were observed to be decreasing till the premium range of 25000-50000 and slowly increasing thereafter.

For corporate agency the lapse rates showed more or less a continuous decreasing trend with increasing premium range. Lapse rate for the channel of insurance broker had fluctuating trend with premium range.

For other (which constituted mostly the referral arrangements direct marketing Micro insurance/rural agents distribution channels like direct sales by employees, specially trained tied agents for selling in specified geographical areas etc), the lapse rates were observed to be decreasing from the range of 5000-10000 to 25000-50000 and with fluctuations thereafter.

8. Combination of factors: Mode and Type of Agency

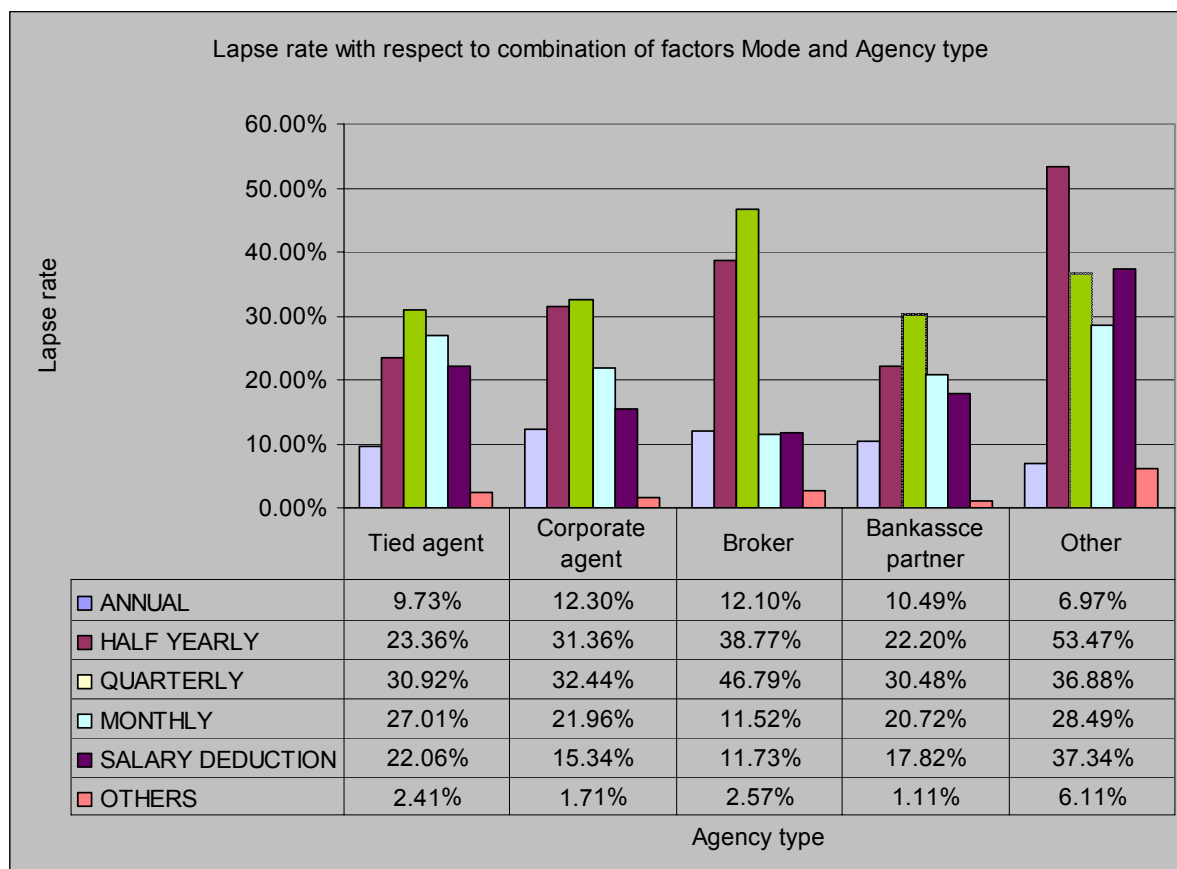


Figure 57

For all types of distribution channels lapse rates were observed to increase with the frequency of the premium payment except for monthly mode where the rates of lapse tend to decrease from quarterly mode. The possible causes for increase in lapse rates with increase in frequency of premium payment could be as stated earlier in the single factor analysis. Lapse rates for the annual mode are observed to remain the same around 10% to 12% for all common types of agency.

Lapse rate in Salary deduction mode is less than that under Monthly mode which could be due increased level of automation in premium payment as the employer directly deducts the premium from the salary and pays to the insurer. However, for employers particularly in the public sector, where automation is not high lapse experience would be different. Further levels of increased automation in case of Electronic transfer of premiums would have caused the lapse rates decreased for the mode 'Others'.

The channels(which constituted mostly the referral arrangements direct marketing Micro insurance/rural agents like direct sales by employees, specially trained tied agents etc.) other than the common types were observed to have the highest rates of lapse for the modes half-yearly and salary deductions and among the common types, tied agency

seemed to have high rates of lapse under monthly and salary deduction modes and Brokers had the highest lapse rates under quarterly and half-yearly modes.

9. Combination of factors: Agency type and Policy type

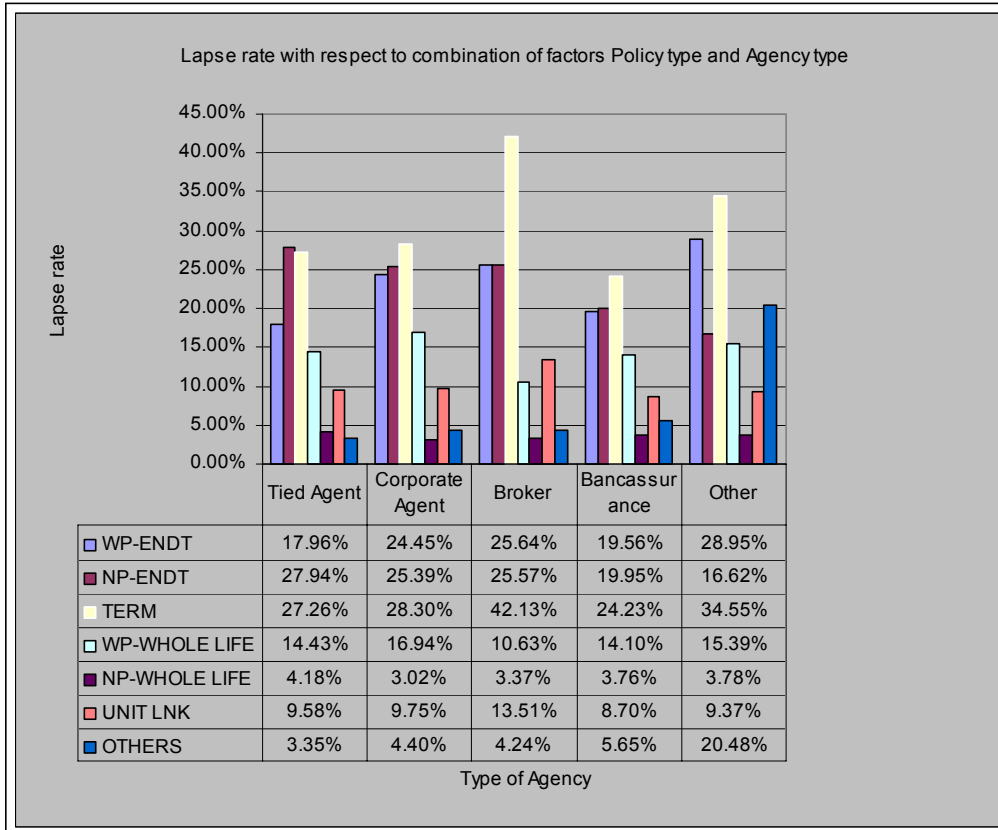


Figure 58

Except with the Tied Agency all other distribution channels showed highest rates of lapse for Term assurance products. For Tied Agency the lapse rate for the Term products is observed to be a little less than the rate for Non-profit endowment products.

Under Tied agency and Corporate agency non-profit endowment policies were observed to have higher lapse rates than the with-profit endowment products. Under the channels Bancassurance and Broker both with-profit and non-profit endowment products had almost equal lapse rates.

Under all the distribution channels with-profit whole life policies showed higher rates of lapse than their non-profit counterparts.

10. Combination of factors: Age at entry and Premium range

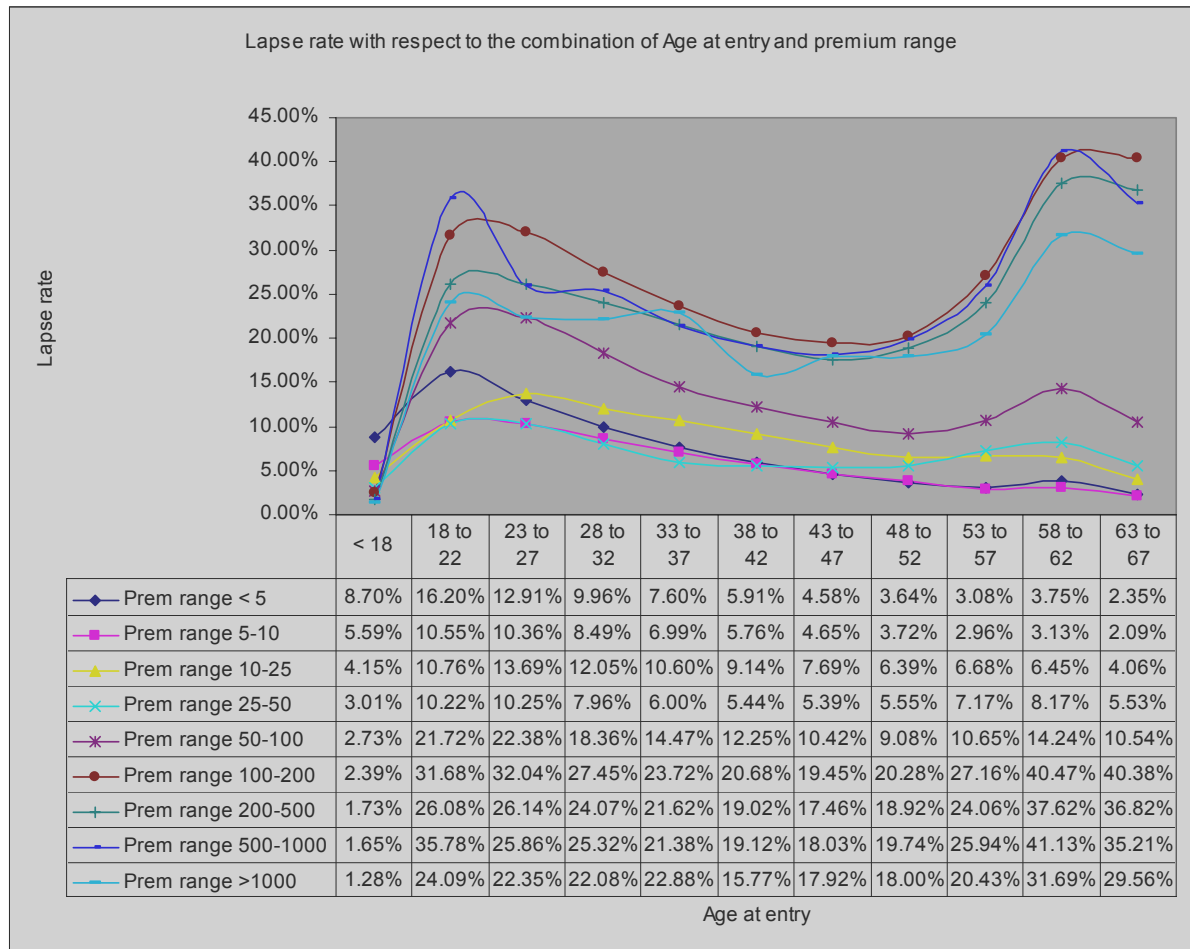


Figure 59

*** Premiums plotted are in 000's.

For premium ranges of less than 5000 and 5000-10000 the lapse rate was observed to decrease from the age range of 18-22. For Premium range of 10000-25000 the lapse rate was observed to decrease from the age range of 23-27. Premium range 100000-200000 appears to have highest lapse rate from the age range of 23-27.

Lapse rates are observed to increase with increase in premium range. For all premium ranges lapse rates tend to decrease from the age band of 18-22 years and start rising from age around 50 years.

For all premium ranges greater than 2, 00,000 lapse rates tend to decrease from the age band of 18-22 years and start rising from age around 50 years. Effect of age was observed to have dominated the trends as this was more significant than premium range in affecting lapse rate.

Other related observations:

For very low premium ranges the lapse rates are observed to be decreasing from the age range 18-22 continuously.

All other premium ranges show a similar trend as that of single factor 'Age' i.e. lapse rates increasing up to the age range of 18-22, decreasing thereafter up to the age range of 48-52 and thereafter increasing with some fluctuations and decrease in the case of low premium-ranges.

At high levels of premium lapse rates observed are very high which might be due to large premiums becoming a burden if income levels fluctuate over time or increase in choice of investment for financially sound section of the society. At very low premium ranges, comparably high lapse rate might be due to inability to continue premium payment by lower income groups of society.

At ages less than 18 years, the premiums are paid by the elders on their children's policies. Hence the lapse rates are observed to be low at very young ages. Lapse rates tended to increase from age 18 years till 23.

The contributing factors for high rates of lapse at younger ages might include:

i) Savings element playing a dominant role, ii) lack of awareness of need for insurance iii) inclination towards alternative risky investment channels yielding high returns and iv) lack of continuity in earnings

Lapse rate for the industry shows a decreasing trend from the age range 18-22 to age range 63-67. Increased levels of awareness of need for insurance between the ages 40 and 65 could have resulted in decreasing rates of lapse. Also, as need for insurance will be felt more as the age advances lapse rates tended to decrease with age.

11. Combination of factors: Mode and Premium range

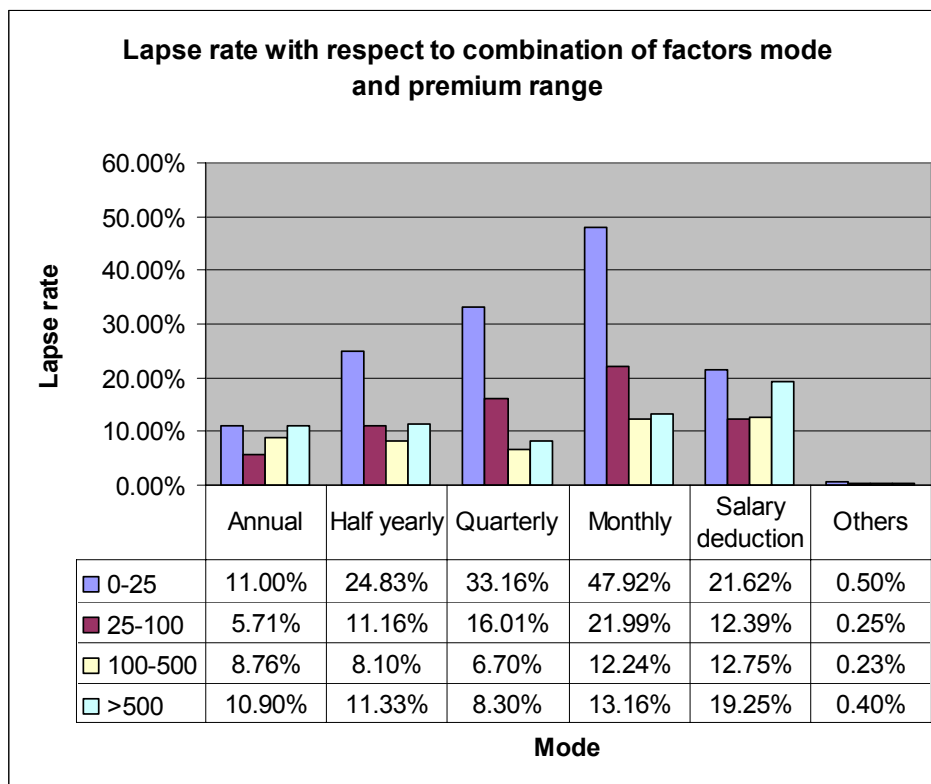


Figure 60

Note: Premium range is in '000 in the above graph.

For premium ranges 0-25000 and 25000-100000 lapse rate was observed to increase with frequency of premium payment. Salary deduction mode has lower lapse rate than under monthly mode.

For premium ranges 100000-500000 annual mode had a little higher rate of lapse than the half yearly, quarterly and salary deduction modes. Salary deduction mode had a little higher lapse rate than monthly mode. (Lapse rate under salary deduction mode largely depends on the efficiency of the employer/paying authority.)

Other modes of premium payment like 'electronic transfer of premium' had negligible lapse rates for all ranges.

Mode of Premium payment was found to be significant both in single factor and two-factor analysis

The possible causes for increase in lapse rates with increase in frequency of premium payment could be i) reduction in grace period for higher frequent modes ii) it will be more expensive to the company to send the premium reminders to the policyholders

every month/quarter than for less frequent modes, also there will be a higher administrative costs associated with higher frequency modes. There is more scope for a policy with more frequent mode of premium payment to lapse than with less frequent mode.(e.g. once premium is paid annual premium policy can not lapse with in that policy year unless surrendered which is not the case with a monthly mode policy.

The cause of lapse rate in Salary deduction mode being less than that under Monthly mode could be due increased level of automation in premium payment as the employer directly deducts the premium from the salary and pays to the insurer. However, as stated earlier lapse rate under the salary deduction mode largely depends on the efficiency of the employer/paying authority.

CHAPTER – VI

Conclusions

6.1 Grouping of companies by lapse rate experience

Combining last three years data, simple arithmetic mean of the industry lapse rate is found to be 18.1% with a standard deviation of 7.5%.

Assuming lapse rates across the industry follows normal distribution with the above mean and standard deviation, four companies fall in the percentile ranging from 35 to 65 i.e. within 15% neighborhood of the industry mean (or mean – 38.5% standard deviation to mean + 38.5% of standard deviation). These four companies can be considered to have lapse rates in average range.

Seven companies fall in the lower percentile ranging from 0 to 35 (i.e. lapse rates less than (mean- 38.5% of standard deviation)) which may be considered to have lighter lapse rates below the average range of the industry.

Five companies fall in the upper percentile ranging from 65 to 100 (i.e. lapse rate greater than mean + 38.5% of standard deviation). These five companies can be considered to have heavier lapse rates above the average range.

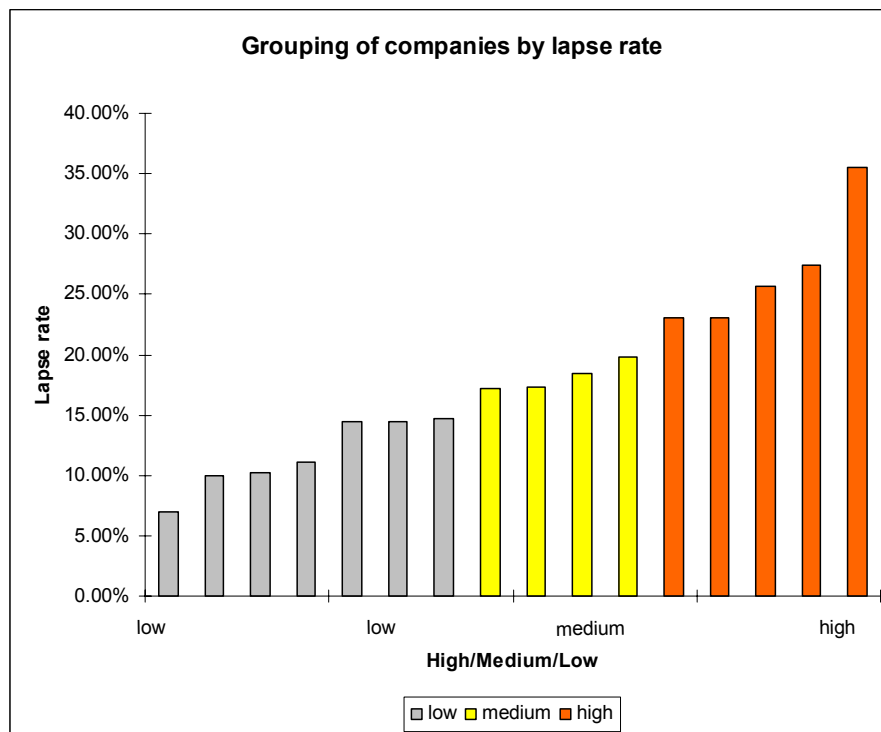


Figure 61

6.2 Other Conclusions using Causal factor Study

6.2.1 The levels of lapse referred to in the following analysis are based on the above grouping of companies.

6.2.2 Revival Campaigns

Number of companies conducting regular revival campaigns: **8**

Among these, the number of companies having different levels of lapse is as following.

Level of lapse	Number of companies
High	1
Average	3
Low	4

Out of the eight companies conducting revival campaigns only one company has high lapse rate.

Number of companies *not* conducting regular revival campaigns: **5**

Among these the number of companies having different levels of lapse rate is as following.

Level of lapse	Number of companies
High	4
Average	0
Low	1

Out of the five companies *not* conducting revival campaigns four companies had high levels of lapse.

Revival campaigns seem to have significant effect in reduction of the levels of lapse rate.

6.2.3. Levels of commission

Number of companies paying commissions *less* than the allowed maximum level: **10**

Among these the number of companies having different levels of lapse rate is as following.

Level of lapse	Number of companies
High	3
Average	3
Low	4

Number of companies paying maximum level of commissions in all cases/with few exceptions: **3**

Level of lapse	Number of companies
High	1
Average	0
Low	2

6.2.4. Incentives to Intermediaries for reduction of lapse rate

Number of companies giving incentives to intermediaries for reducing lapse rate: 4

Among these the number of companies having different levels of lapse rate is as following.

Level of lapse	Number of companies
High	0
Average	1
Low	3

Number of companies *not* giving incentives to intermediaries for reducing lapse rate: 9

Among these the number of companies having different levels of lapse rate is as following.

Level of lapse	Number of companies
High	5
Average	2
Low	2

None of the companies giving such incentives has high levels of lapse.

5 out of 9 companies which are *not* giving any such incentives have high levels of lapse.

Therefore, it seems the special incentives given to intermediaries have significant effect in reducing the levels of lapses. These incentives (e.g. enhancing club membership, imparting more training etc.) are as per product approval conditions.

Combining the above two blocks, one can infer that low commission in the first year contribute to the lower level of lapses in the following years as the commission is well distributed.

6.2.5. Notices to the intermediaries

Number of companies sending copies of lapse notices to the intermediaries: **4**

Among these the number of companies having different levels of lapse rate is as following.

Level of lapse	Number of companies
High	0
Average	2
Low	2

Number of companies not sending copies of lapse notices to the intermediaries/not informing the intermediaries directly: **9**

Among these, the number of companies having different levels of lapse rate is as following.

Level of lapse	Number of companies
High	5
Average	1
Low	3

None of the companies sending copies of notices to the intermediaries has high levels of lapse.

5 out of 9 companies which are not sending copies of notices to the intermediaries have high levels of lapse.

Therefore this causal factor viz. sending copies of notices to intermediaries helps bring down lapses seems to have considerable effect in reducing the levels of lapse.

6.2.6. Reminders and notices to policyholders

All the sample companies from which the causal factor data has been received are observed to have been sending premium notices in advance, reminders after due date to the policyholders and except two companies all other companies are sending final lapse notices to the policyholders. Hence inferences distinguishing the companies basing on this causal factor are difficult to be drawn and the same results as in the grouping of companies in paragraph 6.1 hold good.

Summarising the above,

Number of companies conducting regular revival campaigns	Among these, number of companies having different levels of lapse			Number of companies not conducting regular revival campaigns	Among these, number of companies having different levels of lapse		
8	High	Average	Low	5	High	Average	Low
	1	3	4		4	0	1

Revival campaigns seem to have significant effect in reduction of the levels of lapse rate.

Number of companies paying maximum levels of commission	Among these, no. of companies having different levels of lapse			Number of companies not paying maximum levels of commission	Among these, no. of companies having different levels of lapse		
3	High	Average	Low	10	High	Average	Low
	2	0	1		3	3	4

The fact whether a company pays maximum levels of commission or not doesn't seem to have significant effect in varying the levels of lapse.

Number of companies giving incentives to intermediaries for reduction of lapses	Among these, no. of companies having different levels of lapse			Number of companies not giving any incentives to intermediaries for reduction of lapses	Among these, no. of companies having different levels of lapse		
4	High	Average	Low	9	High	Average	Low
	0	1	3		5	2	2

It seems the special incentives given to intermediaries have significant effect in reducing the levels of lapse.

Number of companies sending notices to intermediaries	Among these, no. of companies having different levels of lapse			Number of companies not sending notices to intermediaries	Among these, no. of companies having different levels of lapse		
4	High	Average	Low	9	High	Average	Low
	0	2	2		5	1	3

Sending copies of notices to intermediaries helps bring down lapses seems to have considerable effect in reducing the levels of lapse.

Same results as in the grouping of companies in paragraph 6.1 hold good for the causal factor of sending reminders to policyholders.

6.3 Issues requiring attention based on lapse study

6.3.1 Lapse rate experience in the Unit linked products versus traditional products

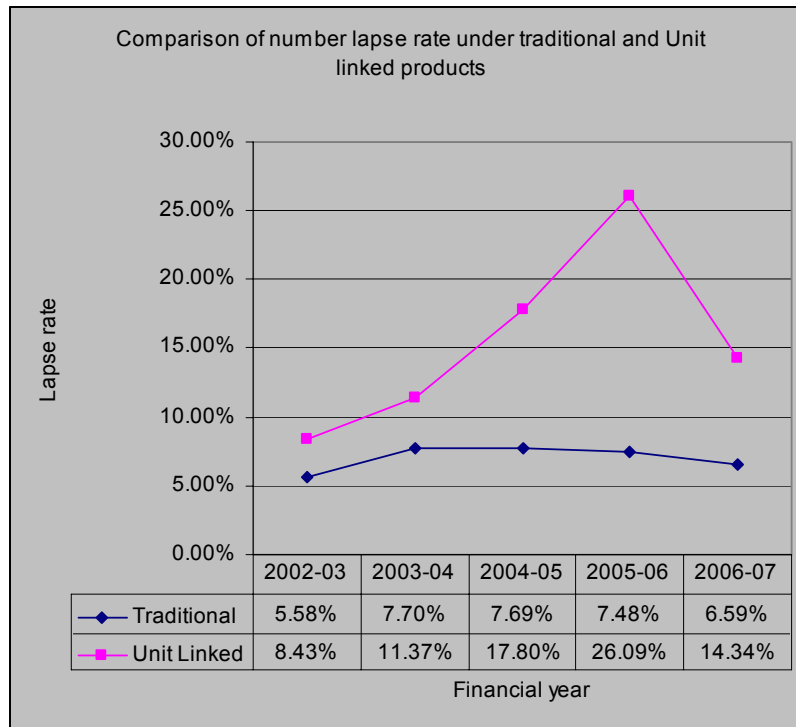


Figure 62

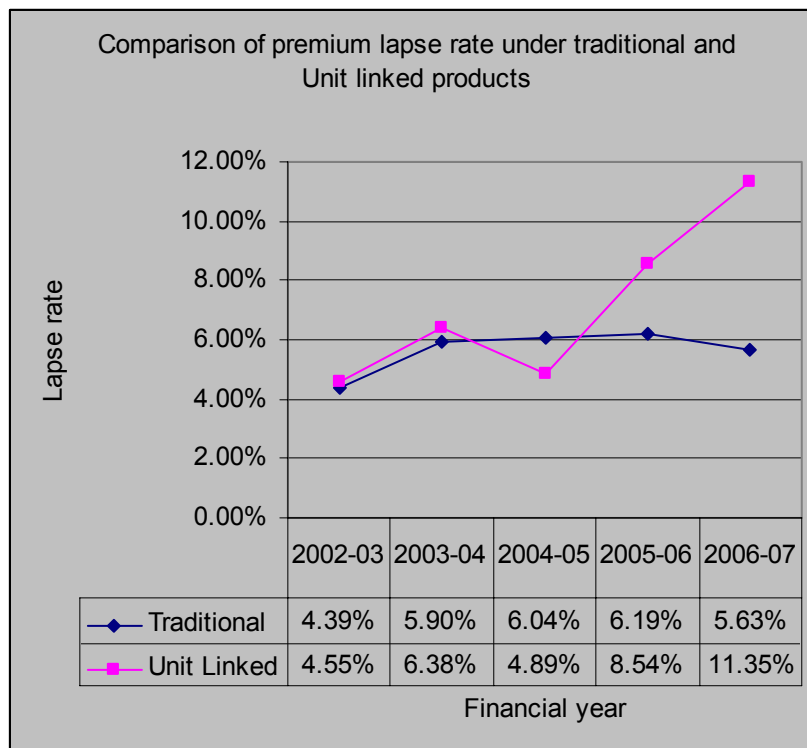


Figure 63

As per the **figure 63**, the industry lapse rate with respect to number remained within 4% to 6% whereas the linked products showed increasing lapse rates since 2004-05.

With respect number of policies lapsed in unit linked products, there is a sharp increase in lapse rate from 17.8% to 26% in 2005-06 but decreased to 14.34% in 2006-07.

The lapse rates with respect to number of policies under Unit linked products are observed to be considerably higher than those under conventional products as evident from the above figures. Excepting term assurance products the following results using three years combined data (2004-05 to 2006-07) reiterate the higher lapse rate in unit linked products than traditional products.

i) With respect to number of policies lapsed:

Lapse rate in Unit linked products: 18.09%

For other type of products (traditional)

Product type	WP Endowment	NP Endowment	Term	WP Whole life	NP Whole life	Pension
Lapse rate	7.08%	4.55%	28.27%	8.51%	3.80%	2.54%

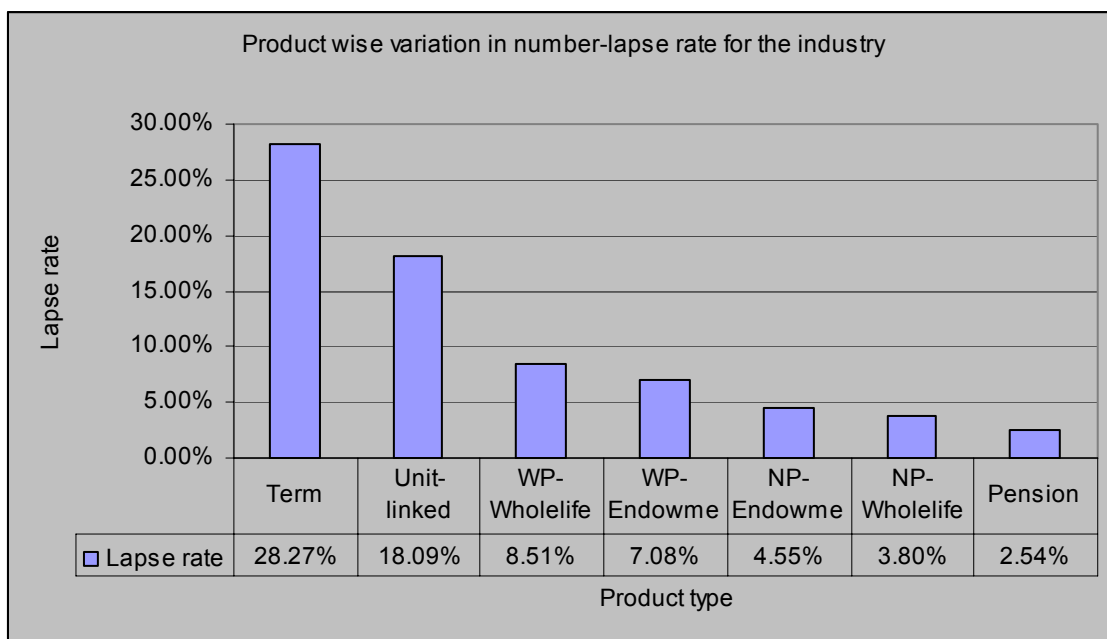


Figure 64

ii) With respect to premium lapsed:

Comparing the premiums lapsed, the difference in lapse rate for Unit-linked products and conventional products other than Term-products is not as big as with number of policies lapsed as per the data following.

Lapse rate in Unit linked products: 10.01%

For other type of products

Product type	WP Endowment	NP Endowment	Term	WP Whole life	NP Whole life	Pension
Lapse rate	5.99%	4.60%	18.95%	6.13%	2.28%	1.79%

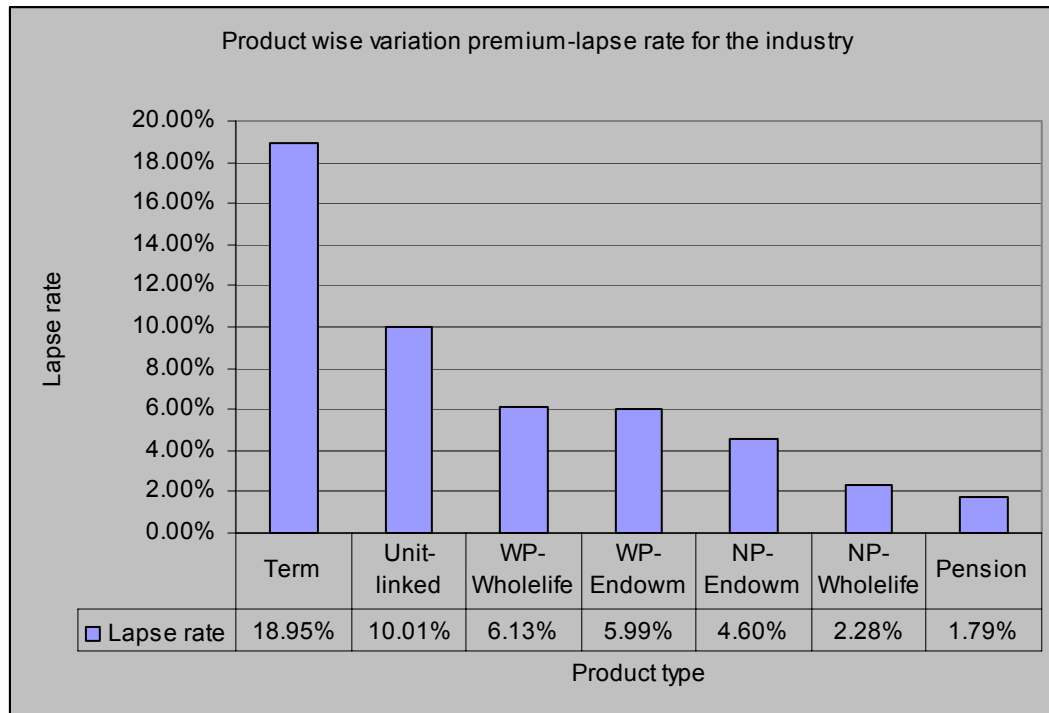


Figure 65

6.3.2 Impact of type of distribution channel on lapse rates

- 1) Type of distribution channel was found to be significant in *only one combination out of five combinations* with other factors.
- 2) Also the factor was not found significant with respect to premium lapsed but found to be a significant factor in affecting the number of policies lapsed.
- 3) The channel Corporate agent showed the highest lapse rate among the common distribution channels followed by Broker, Tied Agency and Bancassurance.
- 4) The channels(which constituted mostly the referral arrangements, direct marketing, Micro insurance/rural agents like direct sales by employees, specially trained tied agents etc.) other than the common types are observed to have the highest rates with considerably high margins as evident from the following.
- 5) Lapse rate with respect to distribution channel largely depends on the level of awareness of the need for insurance that the intermediaries impart to a potential policyholder.

With respect to number of policies lapsed:

Type of channel	Tied Agency	Corporate Agency	Brokers	Bancassurance	Others
Lapse rate	18.56%	26.18%	20.16%	12.84%	51.2%

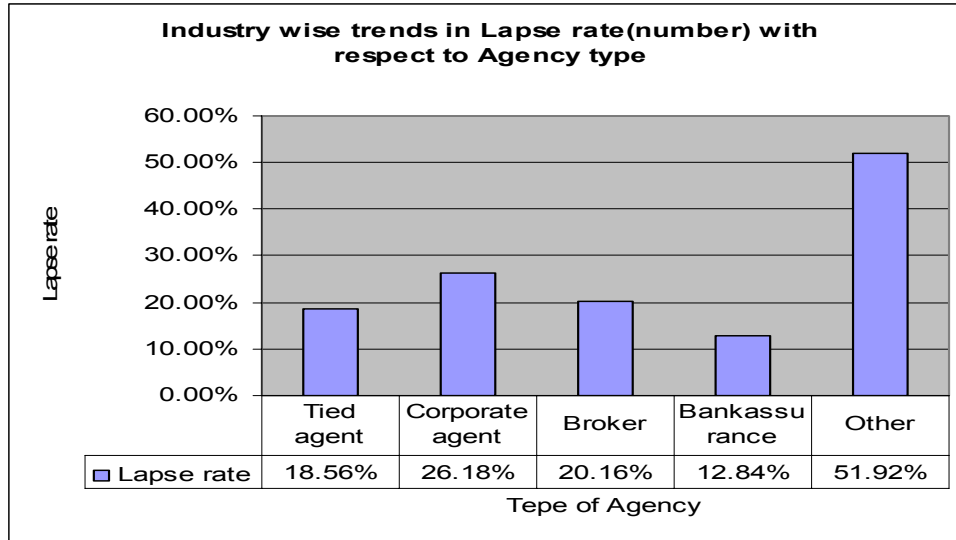


Figure 66

With respect to premium lapsed:

Type of channel	Tied Agency	Corporate Agency	Brokers	Bancassurance	Others
Lapse rate	13.01%	13.89%	14.84%	11.83%	29.65%

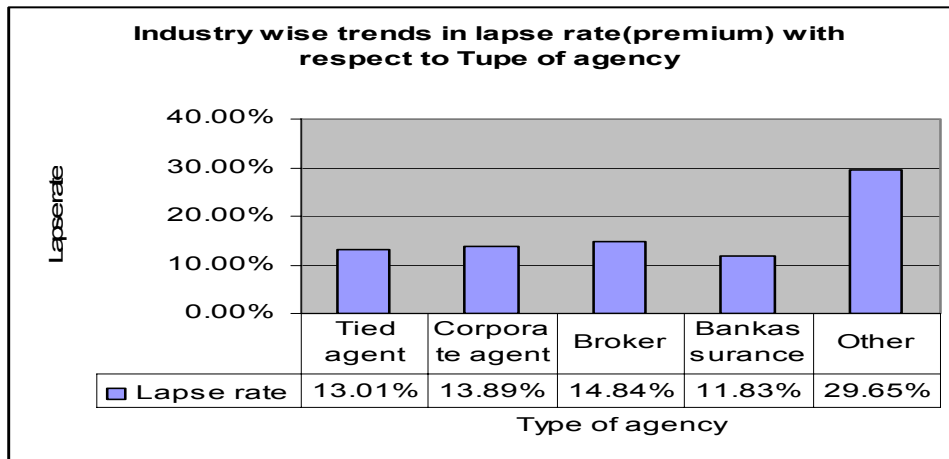


Figure 67

The channel 'Broker' shows the highest lapse rate among the common distribution channels followed by Corporate agent, Tied Agency and Bancassurance.

6.3.3. Relationship between inflation and lapsation

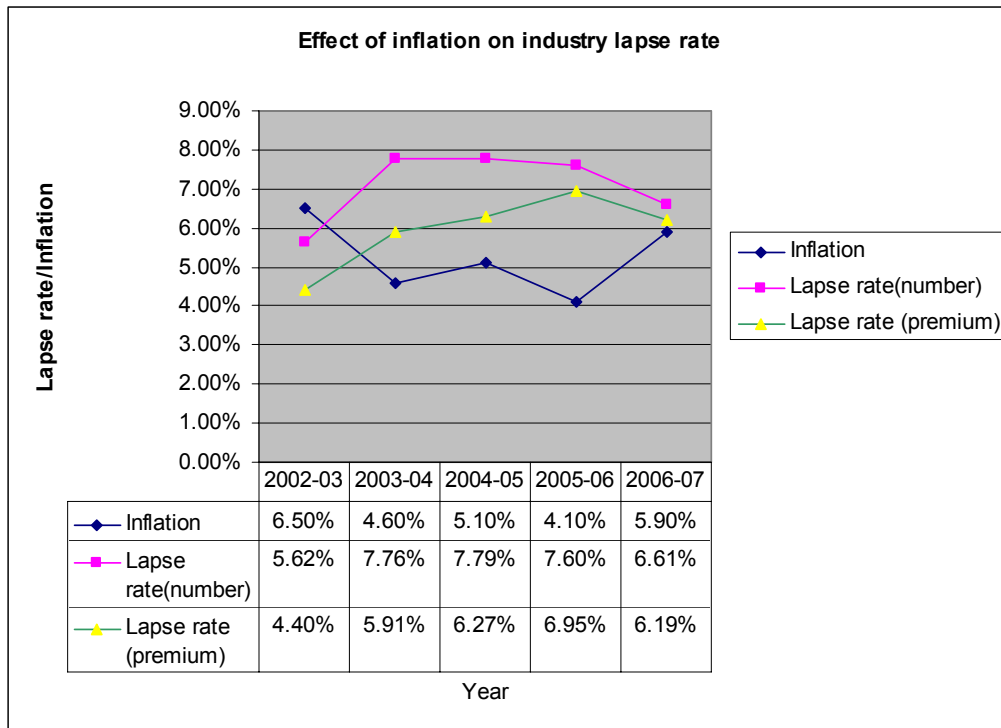


Figure 68

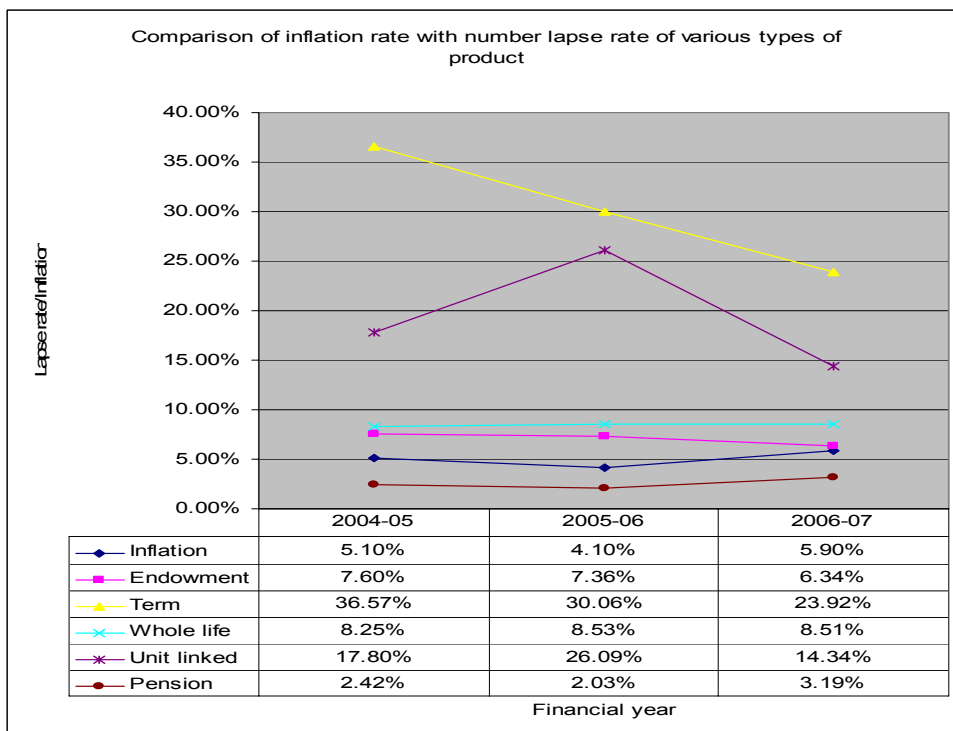


Figure 69

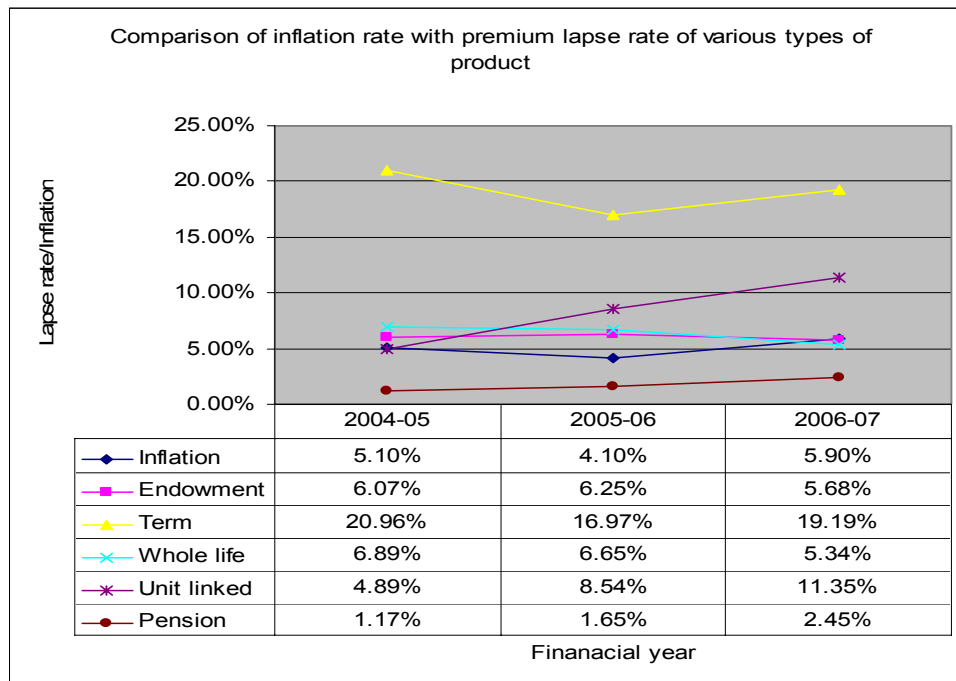


Figure 70

There is no significant evidence to conclude any correlation between inflation and lapse rate. As inflation is a long term phenomenon, large data pertaining to more number of years may be required to draw any meaningful conclusions.

6.3.4 Policyholders' reasonable expectations (PRE) and lapsation:

1. Policyholders' reasonable expectations come basically from the illustrations made by the company at the time of sale of the product. The illustrations may be either orally or in form sales material.
2. Main expectations could be
 - the way in which the profit will be distributed in form of bonuses
 - amount of reversionary bonus
 - amount of terminal bonus
 - degree of smoothing
 - flexibility of surrenders and surrender benefits payable
 - after-sale services like fair grace period
 - service on reminders
 - premium collection facilities and
 - return of fair asset share on lapse (How does a policyholder know this?).
3. If the policyholders' reasonable expectations with respect to any of the above parameters are not met there tends to be an increase in lapse rate.
4. Due to increase in lapse rate, per policy expenses to be born by the company would increase which may lead to losses for the insurer.
5. Also, increase in per policy expenses may lead to reduced bonus rates and volume of new business will be affected.
6. Hence it is essential for every insurer to meet the PRE to keep the business solvent.

6.3.5 The following results in paragraphs 6.3.6, 6.3.7, and 6.3.8 were obtained from a hypothetical model representing a typical product design of an insurance company incorporating the lapse rate-scenario observed for the industry and hence the following discussion may not apply to some companies in certain circumstances. The impact of lapses on solvency, profits and expenses is a complex function involving various factors such as product benefit structure, pricing assumptions and valuation assumptions.

6.3.6 Impact of lapses on reserves and Solvency margin

The increase/decrease in reserve and the level of increase/decrease can be attributed to various factors like i) level of surrender benefit offered ii) level of reserves to be maintained with respect to lapsed policies and iii) strength of expense assumptions in pricing.

a) For an *Endowment type of product (with profits)*: (for a typical endowment policy of term 15 years with age at entry of 35 and sum assured of 25000)

Duration since inception (years)	per unit increase in lapse rate		per unit decrease in lapse rate	
	Change in statutory reserve	Change in solvency margin	Change in statutory reserve	Change in solvency margin
0-3	1.85	0.84	-1.84	-0.83
4-7	0.31	0.22	-0.41	-0.29
8-12	-0.08	-0.07	0.15	0.12
13-15	-0.50	-0.41	0.34	0.28

- Statutory reserve increased with increase in lapses up to seven year duration. After seven years, the statutory reserve decreased with increase in lapses.
- Statutory reserve decreased with decrease in lapses up to seven years. After seven year the statutory reserve increased with increase in lapses.
- Similar was the case with solvency margin. This clearly indicates that lapsation has asymmetrical effects on statutory reserves and on solvency margin.
- The observed changes in reserves might be due to the release of asset share for policies lapsed before acquiring surrender value which could result in increase in the surplus and thereby increase the liability towards existing policies. Hence per policy reserve increased.
- If the policy lapses after acquiring surrender value, no asset share would be released (unless the policy is surrendered) and there is no addition to the surplus from these policies. Hence per policy reserve was less affected.

b) For a *Term assurance* product:

- For a typical term assurance product, there was not considerable effect of increase/decrease of lapses on statutory reserve or solvency margin in the initial seven to eight years after inception of the policy. This was due to the fact that negative mathematical reserves resulting in the initial years lead to zero statutory reserves and constant solvency margin.
- In the later years of the policy, statutory reserves and solvency margin decreased with increase in lapses and vice versa.
- The level of change increased with duration.

For term assurance product with term 20 years with age at entry of 35 years,

Duration elapsed in years	per unit increase in lapse rate		Per unit decrease in lapse rate	
	Change in statutory reserve	Change in solvency margin	Change in statutory reserve	Change in solvency margin
0-8	0.00	0.00	0.00	0.00
9-15	-0.94	-0.03	0.75	0.06
16-20	-1.79	-0.04	1.96	0.05

c) For a *Unit-Linked* product:

For an age at entry 35 years, Sum assured of 2 lacs and term of 15 years, statutory reserve in respect of non-unit fund decreased with increase in lapses and the level of decrease was higher with duration elapsed since policy inception.

Duration since inception (years)	Change in statutory reserve	
	Per unit increase lapse rate	Per unit decrease in lapse rate
0-5	-0.15	0.32
6-10	-0.35	0.95
11-15	-0.78	0.57

6.3.7 Effect of early lapses on spread of expenses

Initial Expenses: The loading for initial expenses will be spread uniformly (for level premium policies) over a specified period (say 2/5 years). If there are higher lapses than those assumed in pricing in the early years of the policy and reserving basis is not prudent with respect to lapses, there would be less scope for the company to recoup the expenses, which results in capital strain for the company. The effect would be more profound on term-assurance policies than on endowment type of policies due to larger impact on the premiums.

Lower number of lapses than those assumed in the pricing basis may help the company in recouping the initial expenses but over all effect on company's profitability and capital

requirements largely depends on many other factors like level of supervisory reserves, surrender benefits offered etc.

Renewal variable Expenses: Renewal variable expenses (like commissions to the intermediaries, administrative expenses like those incurred for sending premium receipts sending bonus information etc.) for a given group of policies decrease with increase in lapses. This is due to the fact that the renewal expenses largely depend on the number of in-force policies and increase (decrease) with increase (decrease) in the number of in-force policies.

Overhead expenses/Fixed expenses: These are the expenses which almost remain constant irrespective of the level of business (like rent paid for the office premises, wages to the staff etc.) unless there is a substantial change in the level of business written.

As such expenses are distributed over the policies in force at any point of time, higher lapses resulted in lower number of policies in force and hence the per policy expense increased with increase in lapses. The level of increase in expense raised during the term of the policy which could be due to inflation of expenses.

Similar reasoning applies to the case of decrease in lapse rate.

For a typical endowment assurance policy with term of 35 years with age at entry of 35 years,

Duration since inception(years)	Change in over head expenses	
	Per unit increase in lapse rate	Per unit decrease in lapse rate
0-6	0.20	-0.37
7-16	0.70	-0.45
17-35	1.03	-0.97

6.3. 8. Effect of lapsation on profits of insurance company

a) For an Endowment type of product (without profits):

- For a typical age at entry, higher losses were observed with higher lapses in the first policy year which might be due to heavy initial expenses for which loading has been spread over the term of the contract and high negative asset share.
- After the first policy year and up to the period during which no surrender value was payable, the profit increased with increase in lapses which might be due to the nil outgo from the company on lapses and the total asset share released the profit to the company.

- At the first one or two year duration, over which surrender value begins to become payable, the profit for the company increased with lapses but the increase was smaller than that before the surrender-eligibility period.
- Profit increased even at later durations due to excess of asset share over the surrender value.
- The rise in profit with rise in lapses increased with duration after the commencement of surrender-eligibility period.

For a typical endowment policy of term 15 years with age at entry of 35 for sum assured of 25000,

Duration since inception(years)	Change in profit	
	Per unit increase in lapse rate	Per unit decrease in lapse rate
0-1	-7.99	4.47
1-6	0.93	1.35
7-10	0.91	0.92
10-15	0.95	0.61

b) For a Term assurance product:

- For a typical term insurance product, profits decreased with increase in lapses at all most all durations of the term. The rate of decrease was higher in initial years than in the later years.
- The decrease in profits with increase in lapses could be attributed to i) low premiums charged which do not cover the expenses unless received fully ii) increase in lapses resulting from selective withdrawals which tend to increase the average mortality of the remaining policyholders exposed to risk and hence mortality cost increases.

For term insurance product with term 20 years with age at entry of 35 years,

Duration since inception(years)	Change in profit	
	Per unit increase in lapse rate	Per unit decrease in lapse rate
0-3	-0.16	0.84
4-8	-0.39	2.01
9-12	-0.23	0.37
13-19	-0.65	0.85
19-20	-0.09	0.13

c) **For a Unit-Linked product:**

- For an age at entry 35 years, Sum assured of 2 lacs and term of 15 years, higher profit/lower loss was observed with higher lapses in the first three years. However, the level of increase in profits decreased as the duration elapsed which could be low initial allocation rates and high surrender penalties. In later years of the policy term, higher lapses resulted in decrease in profits and the level of decrease increased with duration.
- Converse is the case with decrease in lapse rate.

Duration since inception(years)	Change in profit	
	Per unit increase in lapse rate	Per unit decrease in lapse rate
0-3	0.16	-0.28
4-10	-0.24	0.67
10-15	-0.71	0.57

CHAPTER – VII

Recommendations for future study

7.1 Using common lapse definition for the study

Heterogeneity in the definition of lapse among the companies leads to many difficulties for the study of lapses and comparison of lapse/persistency rates among companies. Adjustment of data to conform to a uniform definition of lapse may result in distortion of results and impart spurious accuracy. Also varied definition of lapse may lead to misinterpretation of a company's performance relative to others. As such, much emphasis must be placed on uniform definition of lapse. (For meaningful analysis of industry lapses, it is necessary that the life insurers follow uniform definition of "Lapse" for lapse data submitted to the Authority, which would include Form DDD and Form DDDD.)

To consider recommending a uniform lapse definition, the impact of length of grace period needs to be examined.

Grace period can provide the advantage of payment of premiums by policyholders within reasonable time limit from the exact due date; loss of life cover during such small interim period could defeat the very purpose of life insurance.

However, such facility should not lead to a habitual procrastination of premium payments which all due.

Short grace period: A relatively short grace period may increase the lapse rate and also be unfair to policyholders. There might be some who argue that it may accelerate the premium income if the policyholders are much conscious about regular premium payment. Also, there will be marketing complications if the grace period set is lower than that of other companies.

A company which is younger in the market may find it more difficult to fix a short grace period.

Long grace period: On the other hand, a relatively long grace period may force the insurer to provide free cover (period for which no premium is received) for a longer period and this may result in loss to the insurance company.

In view of this, it is recommended to have a uniform grace period of 30 days for annual, half yearly and quarterly modes and 15 days for monthly mode and to consider a policy lapsed if the premium is not paid within the grace period. (Uniform "Grace Period" and uniform "Lapse Definition" across the industry shall go together.) Policies, for which the premiums are paid after the grace period date may be treated as reinstatements, provided the premium is paid within the revival period of 2 to 5 years, as per insurers' internal practice.

Companies may be asked to follow this definition even for reporting purposes to IRDA.

The lapse may be either a pure lapse without acquiring any paid-up/surrender value or otherwise, the same definition of lapse as above is recommended to be used. As such, the definition of lapse is equally applicable for both conventional as well as Unit linked products.

Pending initiation of steps to introduce/modify policy contracts to use definition of lapse recommended above, companies may modify their IT programs for submission of data using the above definition of lapse for lapse study (and also “D” Forms).

7.2 Multivariate regression model for the industry incorporating the significant factors

From the results of the statistical analysis made in the chapters III & IV using ANOVA principles and simple hypothesis testing methods, the most significant factors (first four in the order of level of significance) with respect to which the lapse rates vary are

- 1) Duration elapsed since policy inception
- 2) Mode of premium payment
- 3) Age at entry and
- 4) Type of policy.

Lapse rates of a company/industry can be modeled as a function of these significant factors as mentioned in the **Annexure-8**.

7.3 Usefulness of such model:

Such a model will be useful for

- i) comparison of lapse rates from year to year
- ii) comparison between companies and
- iii) planning the business strategies.

7.4 Alternative approaches and Data requirements

7.4.1 Cohort study: For such type of study we need to keep track of a homogeneous group of policies having similar characteristics. For example, if we take policies issued in a given month of a financial year and we need to study the 13th month, 25th month, 37th month persistency rates of the cohort (say $C_{\text{April } 03}$) of policies issued in April 2003, we need to observe the number of policies in force in May 2004, May 2005, May 2006 respectively out of the cohort $C_{\text{April } 03}$ and take the ratio of number of policies in force to the original number of policies in the cohort $C_{\text{April } 03}$ to calculate the persistency rates. Data may be required in the following format.

Number of policies issued in April 2003	Number of policies in force in May 2004 with month of commencement as April 2003	Number of policies in force in May 2005 with month of commencement as April 2003	Number of policies in force in May 2006 with month of commencement as April 2003

Even though cohort study has the advantage of homogeneity in data, it can not be applied to any other cohort of different characteristics unless we study five to six different cohorts, i.e. even if the data were derived from a cohort study there would be problems in applying the results derived for a subgroup of policyholders to an individual policyholder. This bias arises because the members of a well-defined subgroup are inevitably mixed with respect to their propensity to experience the decrement (here the decrement of lapse) under the study.

7.4.2 Alternatively, we can fix the observation period (instead of fixing a cohort of policies) and observe the persistency rates with in that period. For example, if take the observation period as 1st April 2006 to 31st March 2007 and want to observe the 13th month persistency the data are to be submitted in the following format.

No.	Month of commencement	Number of policies commenced (Net of cancellations)	Month of commencement + 13 months (This column pertains to the period of investigation)	Number of policies in force at duration '13 months' falling during the period of investigation
1	3/05		4/06	
2	4/05		5/06	
3	4/05		6/06	
4	6/05		7/06	
5	7/05		8/06	
6	8/05		9/06	
7	9/05		10/06	
8	10/05		11/06	
9	11/05		12/06	
10	12/05		1/07	
11	1/06		2/07	
12	2/06		3/07	
	Total 1		Total 2	

Persistency rate is given by the ratio of Total 2 to Total 1.

Similar will be the requirement for further persistency rates.

The above analysis amounts to use of different cohorts for different persistency rates.

Approximation of Persistency rate in line with the above method

With the available data with respect to the single factor ‘duration’, approximate rates of persistency are calculated as follows.

Period of observation has been fixed as 2006-07. To find out say 37th month persistency, we need to observe the ratio of the policies which complete three policy years at the end of the year 2006-07 to the original number of policies issued three years back, i.e. we need to keep track of the policies issued in 2004-05 (with duration 0 in 2004-05). If $L_{(year\ y)(duration\ k)}$ represents the lapse rate in the year y of the policies with duration k , $(1-L_{04-05(duration\ 0)})$ gives us the approximate proportion of the policies remaining in force at the end of 2004-05. The product $(1-L_{04-05(duration\ 0)}) * (1-L_{05-06(duration\ 1)})$ gives us the proportion of the policies remaining in force at the end of 2005-06 and finally the product $(1-L_{04-05(duration\ 0)}) * (1-L_{05-06(duration\ 1)}) * (1-L_{06-07(duration\ 2)})$ gives us the approximate proportion of the policies (issued in 2004-05) remaining in force at the end of 2006-07 which in turn gives approximate 37th month persistency.

Similar is the case with persistency rates for other durations of months.

Ideally, to calculate precise value of persistency over a period of observation, the data required is as mentioned in the above table.

But the data called for the lapse study was in different format as objective of the study was different from the calculation of persistency over a fixed period and the data available and how the approximation was done were as following.

For each of the financial years from 2002-03 to 2006-07, the central exposed to risk and the total number of lapses out of those exposed to risk noted in that financial year for each of the durations elapsed from 0 to 8 years where duration k implies those policies whose duration elapsed since inception falls between k to $k + 1$ number of years.

For one year/13th month persistency for the observation period 2006-07, (One) minus (the ratio of lapses of policies with duration 0 years and corresponding exposed to risk of 2006-07) was taken as approximation for one year persistency i.e. 13th month persistency.

For two-year/25th month persistency rate, the product of (A) and (B) was taken as approximation where

- (A) is (One) minus (the ratio of lapses of policies with duration 0 years and corresponding exposed to risk of 2005-06)
- (B) is (One) minus (the ratio of lapses of policies with duration 1 year and corresponding exposed to risk of 2006-07).

Similar approximations were made for further persistency rates.

Such analysis resulted in the following trend for the persistency rates for the entire industry for the period of observation 2006-07.

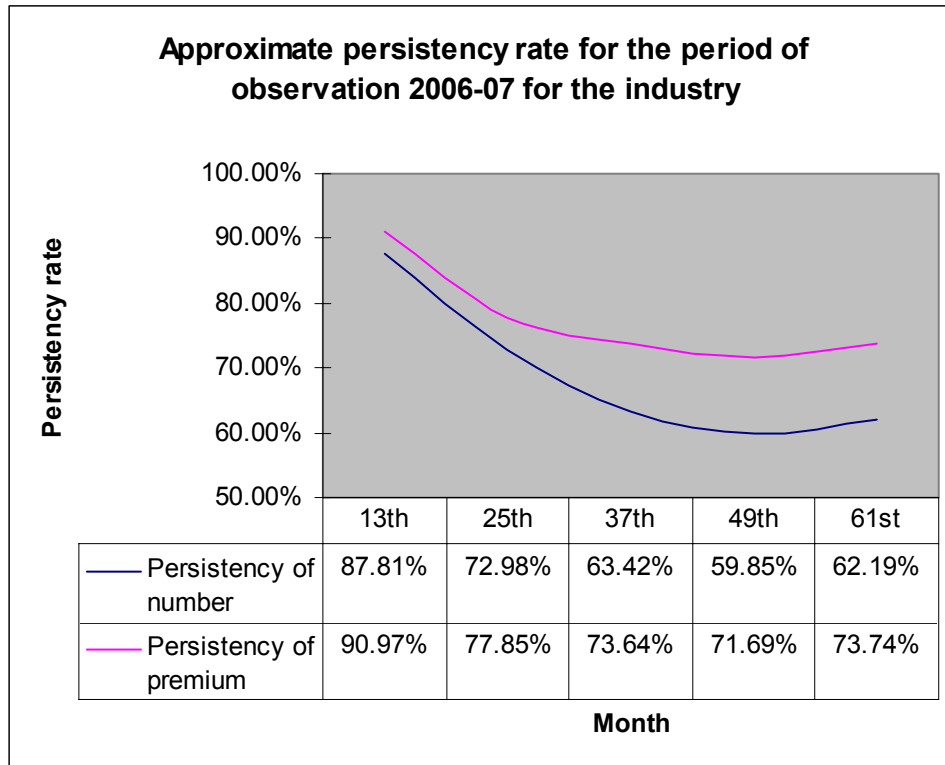


Figure 71

From figure 71, persistency rate has been observed to be decreasing up to 49th month with a slight increase in 61st month. Also the rate of decrease in persistency rate is observed to be decreasing till 49th month.

Persistency with respect to premium is observed to be higher than that with respect to number which might be due to higher average premium per policy.

In conclusion,

The above report can be treated as a beginning for the study of lapses in the Indian insurance industry. It will be more useful to continue the study in future obtaining data from all the companies with respect to all combinations of the factors found significant in this study and all interactions of such significance.

The data will have to be collected with a predetermined uniform definition of lapse (for the purpose of study) from the companies irrespective of the manner in which the data base is maintained with the company.

A suitable statistical package must be also available with the study group to make the study easier and to model the lapse rates using statistical techniques.

Participating companies will have to be clearly instructed to make a thorough scrutiny of the data before sending the same for the study and to make the data error-free wherever possible.

The study may be extended to cover reinstatements within a period of 3 years from date of lapse.

Bibliography

1. *Sarma K P (1987), "LAPSES AND SURRENDERS OF LIFE INSURANCE POLICIES , An analysis of experience of Rajkot Divisional office of Life Insurance Corporation of India for the year 1985-86 ". National Insurance Academy, Mumbai-400001*
2. *A.E Renshaw and S.Haberman(1986), "Statistical analysis of Life assurance lapses." Journal of Institute of Actuaries 113-1986 The Institute of Actuaries, U.K.*
3. *A joint study sponsored by Limra International and The Society of Actuaries for the observation period 2001-02 (2005), "U.S. Individual Life Persistency Update"*

A. Single Factor Data:

1. Age wise
2. Duration wise (i.e. with duration elapsed since inception of the policy)
3. Original Premium Paying term wise
4. Premium-Range wise
5. Underwriting-type wise
 - i) Medical
 - ii) Non-Medical
6. Agency-type wise
 - i) Tied Agent
 - ii) Broker
 - iii) Corporate Agent
 - iv) Bancassurance
 - v) Other
7. Mode wise
8. Policy Type wise
 - i) Endowment – Par
 - ii) Endowment –Non – Par
 - iii) Term
 - iv) Whole Life – Par
 - v) Whole Life - Non – Par
 - vi) Unit Linked
 - vii) Pensions
9. Sex wise
10. Rural – Urban Sector wise

Other single factors were believed to be not important.

Annexure-2

Statement of exposure and lapses by year by < factor > group- Numbers

< factor >		Financial year 2002-03		Financial year 2003-04		Financial year 2004-05		Financial year 2005-06		Financial year 2006-07	
Lower limit	Upper limit	No of lapses during the year	Exposed to risk during the year	No of lapses during the year	Exposed to risk during the year	No of lapses during the year	Exposed to risk during the year	No of lapses during the year	Exposed to risk during the year	No of lapses during the year	Exposed to risk during the year
Total											

Statement of exposure and lapses by year by < factor > group- Premium

< factor >		Financial year 2002-03		Financial year 2003-04		Financial year 2004-05		Financial year 2005-06		Financial year 2006-07	
Lower limit	Upper limit	Prem lapsed during the year	Prem Exposed to risk during the year	Prem lapsed during the year	Prem Exposed to risk during the year	Prem lapsed during the year	Prem Exposed to risk during the year	Prem lapsed during the year	Prem Exposed to risk during the year	Prem lapsed during the year	Prem Exposed to risk during the year
Total											

Two Factor Data

1. Duration and Age
2. Duration and original Premium paying term
3. Duration and Premium range
4. Duration and Agency
5. Duration and Policy type
6. Agency and original Premium paying term
7. Agency and Premium Range
8. Agency and Mode
9. Agency and Policy type
10. Premium Range and Age
11. Premium Range and Mode

Other two-factor combinations were believed to be not important.

Annexure-4

Statement of exposure and lapses by year by < factor1 > and < factor2 > Numbers

< factor1 >		Financial year 2002-03		Financial year 2003-04		Financial year 2004-05		Financial year 2005-06		Financial year 2006-07	
		<factor2>		<factor2>		<factor2>		<factor2>		<factor2>	
Lower limit	Upper limit	No of lapses during the year	Exposed to risk during the year	No of lapses during the year	Exposed to risk during the year	No of lapses during the year	Exposed to risk during the year	No of lapses during the year	Exposed to risk during the year	No of lapses during the year	Exposed to risk during the year
Total											

Statement of exposure and lapses by year by < factor1 > and < factor2 > Premium

< factor1 >		Financial year 2002-03		Financial year 2003-04		Financial year 2004-05		Financial year 2005-06		Financial year 2006-07	
		< factor2 >		< factor2 >		< factor2 >		< factor2 >		< factor2 >	
Lower limit	Upper limit	Prem lapsed during the year	Prem to risk during the year	Prem lapsed during the year	Prem Exposed to risk during the year	Prem lapsed during the year	Prem Exposed to risk during the year	Prem lapsed during the year	Prem Exposed to risk during the year	Prem lapsed during the year	Prem Exposed to risk during the year
Total											

Process of ANOVA test to find out the significance of the factors

ANOVA test is basically used in situations where we want to compare the means of several different groups by observing samples in each group. We assume a hypothesis (called null hypothesis) that there is no difference between the means of different groups and we perform the test to know whether the results give any evidence to accept/reject the null hypothesis. The applicability of the test to our case of finding significant factors in affecting the lapses is as follows.

We take the value of lapse-rates for several years with respect to each value of the factor under consideration. e.g. if we take age group at entry as the factor to be tested we arrange the data as follows.

Financial year→	2004-05	2005-06	2006-07
<i>Age group 1</i>	20.85%	21.33%	22.44%
<i>Age group 2</i>	11.59%	15.21%	17.08%
<i>Age group 3</i>	3.68%	7.55%	14.16%

The null hypothesis is that there is no difference between the means of lapse rates under different age groups. If, with the test, it is found that there is no evidence to rule out the null hypothesis then we can say that the population means are the same for all the age groups and Age group is not found to be a significant factor in affecting the lapse rates. On the contrary, if the test indicates significance, then we infer that age is a significant factor affecting lapse rates.

Calculate the Variation between Groups

The first step is to calculate the variation between groups by comparing the mean of each group (or, in this example, the mean lapse rate of each of the three age groups) with the mean of the overall sample (the mean lapse rate on the test for all age groups and years in this sample). This measure of between-group variance is referred to as "between sum of squares" or BSS. BSS is calculated by adding up, for all groups, the difference between the group's mean and the overall population mean, multiplied by the number of cases in the group. In formula terms:

$$BSS = n_1 (\bar{X}_1 - \bar{X})^2 + n_2 (\bar{X}_2 - \bar{X})^2 + n_3 (\bar{X}_3 - \bar{X})^2$$

$$\bar{X}_1 = (20.85\% + 21.33\% + 22.44\%) / 3$$

$$\bar{X} = (20.85\% + 21.33\% + 22.44\% + 11.59\% + 11.59\% + 17.08\% + 3.68\% + 7.55\% + 14.16\%) / 9$$

Plugging in the values, we get the following:

$$BSS = 3(21.5\% - 14.87\%)^2 + 3(14.62\% - 14.87\%)^2 + 3(8.46\% - 14.87\%)^2$$

This sum of squares has a number of degrees of freedom equal to the number of groups minus 1. In this case, $df_B = (3-1) = 2$

We divide the BSS figure by the number of degrees of freedom to get our estimate of the variation between groups, referred to as "Between Mean Squares" as:

$$\text{Between Mean Squares} = \text{BSS}/df = 0.02553/2 = 0.0126612$$

2. Calculate the Variation Within Groups

To measure the variation within groups, we find the sum of the squared deviation between lapse rate and the group average, calculating separate measures for each group, and then summing the group values. This is a sum referred to as the "within sum of squares" or WSS. In formula terms, this is expressed as:

$$\text{WSS} = (n_1 - 1)SD_1^2 + (n_2 - 1)SD_2^2 + (n_3 - 1)SD_3^2$$

Where n_j is the number of students in group j
and SD_j is the standard deviation for group j

With the values from above in this formula, we have:

$$\text{WSS} = (3-1) 0.123^2 + (3-1) 0.027908^2 + (3-1) 0.053031^2$$

$$\text{WSS} = 0.007484866$$

As in step 1, we need to adjust the WSS to transform it into an estimate of population variance, an adjustment that involves a value for the number of degrees of freedom within. To calculate this, we take a value equal to the number of cases in the total sample (N), minus the number of groups (k). In formula terms,

$$df_w = (N - k)$$

$$df_w = (9-3)$$

$$df_w = 6$$

Then we can calculate the a value for "Within Mean Squares" as

$$\begin{aligned} \text{Within Mean Squares} &= \text{WSS}/6 \\ &= 0.007484866/6 \\ &= 0.00124747 \end{aligned}$$

3. Calculate the F test statistic

This calculation is relatively straightforward. Simply divide the Between Mean Squares, the value obtained in step 1, by the Within Mean Squares, the value calculated in step 2.

$$F = (\text{Between Mean squares} / \text{Within Mean Squares})$$

$$= (0.012833/0.00124747)$$

$$= 10.28$$

Then compare this value to a standard table with values for the F distribution to calculate the significance level for the F value ([link to F-test calculator](#)). In this case, the significance level is less than 0.05. This is extremely strong evidence against the null hypothesis, indicating that lapse rate does vary significantly across the three classes and hence Age is a significant factor in influencing the lapse rate.

Summary of the statistical results are arranged as follows.

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F- crit</i>
Between Groups	0.025532	2	0.012833	10.28	0.010911	5.143249
Within Groups	0074848	6	0.00124747			
Total	0.0330168	8				

SS –Sum of the squares.

df - degrees of freedom.

MS- Mean of the squares.

The ANOVA is applied to a host of factors both on a single factor basis and on two factor combinations in a similar way. The analysis and results are described in the report.

For the industry as a whole:***1. Factor: Age group***

Using number of policies lapsed

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.048061	10	0.004806	24.36281	1.25E-09	2.296694
Within Groups	0.00434	22	0.000197			
Total	0.052401	32				

Using premium lapsed

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.020508	10	0.002051	22.60447	2.6E-09	2.296694
Within Groups	0.001996	22	9.07E-05			
Total	0.022504	32				

As test statistic value is greater than the F (10, 22) at 5% level of significance the factor **Age group is found to be significant with respect to both number and premium lapsed.**

2. Factor: Duration elapsed

Using number of policies lapsed

<i>Source of Variation</i>	<i>SS</i>	<i>Df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.061051	9	0.006783	20.7116	2.89E-08	2.392817
Within Groups	0.00655	20	0.000328			
Total	0.067602	29				

Using premium lapsed

<i>Source of Variation</i>	<i>SS</i>	<i>Df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.027612	9	0.003068	24.63355	6.26E-09	2.392817
Within Groups	0.002491	20	0.000125			
Total	0.030102	29				

As test statistic value is greater than the F (9, 20) at 5% level of significance the factor **duration is found to be significant with respect to both number and premium lapsed**

3. Factor: Premium paying term

Using number of policies lapsed

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.001464	4	0.000366	2.001867	0.170234	3.47805
Within Groups	0.001828	10	0.000183			
Total	0.003291	14				

Using premium lapsed

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.001903	5	0.000381	11.54332	0.0003	3.105875
Within Groups	0.000396	12	3.3E-05			
Total	0.002299	17				

As test statistic value is less than the F (4, 10) at 5% level of significance the factor **Premium paying term is found to be not significant with respect to number but significant with respect to premium lapsed.**

4. Factor: Premium range

Using premium lapsed

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.00624	8	0.00078	0.956467	0.497782	2.510156
Within Groups	0.014678	18	0.000815			
Total	0.020918	26				

As test statistic value is less than the F (8, 18) at 5% level of significance the factor **Premium range is found to be not significant in affecting the Lapse rate.**

5. Factor: Type of Underwriting

Using number of policies lapsed

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	0.00178	2	0.00089	9.071293	0.01535	5.143249
Within Groups	0.000589	6	9.81E-05			
Total	0.002369	8				

Using premium lapsed

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	0.003869	2	0.001934	116.3785	1.59E-05	5.143249
Within Groups	9.97E-05	6	1.66E-05			
Total	0.003969	8				

As test statistic value is greater than the F (2, 6) at 5% level of significance the factor **Type of Underwriting (Medical/Non-Medical/Others)** is found to be **significant** with respect to both number of policies and premium lapsed.

6. Factor: Type of Agency

Using number of policies lapsed

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.037238	4	0.009309	15.68867	0.000261	3.47805
Within Groups	0.005934	10	0.000593			
Total	0.043172	14				

Using premium lapsed

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.002997	4	0.000749	1.379786	0.308617	3.47805
Within Groups	0.005431	10	0.000543			
Total	0.008428	14				

As test statistic value is greater than the F (4, 10) at 5% level of significance the factor **Type of Agency (Medical/Non-Medical/Others)** is found to be **significant** with respect to number of policies lapsed .

But the value of test statistic value is less than the F(4,10) at 5% level of significance the factor **Type of Agency** is found **not to be significant** with respect to premium lapsed.

7. Factor: Mode

Using number of policies lapsed

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.201089	5	0.040218	65.34577	2.77E-08	3.105875
Within Groups	0.007386	12	0.000615			
Total	0.208474	17				

Using premium lapsed

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.100361	5	0.020072	30.55429	1.99E-06	3.105875
Within Groups	0.007883	12	0.000657			
Total	0.108244	17				

As test statistic value is greater than the F(5,12) at 5% level of significance the factor **Mode** is found to be **significant with respect to both number and premium lapsed.**

8. Factor: Type of policy

Using number of policies lapsed

<i>Source of Variation</i>	<i>SS</i>	<i>Df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.190516	6	0.031753	19.02869	5.46E-06	2.847727
Within Groups	0.023361	14	0.001669			
Total	0.213878	20				

Using premium lapsed

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.054446	6	0.009074	14.19832	3.09E-05	2.847727
Within Groups	0.008948	14	0.000639			
Total	0.063393	20				

As test statistic value is greater than the F(6,14) at 5% level of significance the factor **Type of policy** is found to be **significant** with respect to both number of policies and premium lapsed .

9. Factor: Sex

Using number of policies lapsed

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	0.000174	1	0.000174	5.337799	0.081999	7.70865
Within Groups	0.00013	4	3.25E-05			
Total	0.000304	5				

Using premium lapsed

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	6.64E-05	1	6.64E-05	1.966895	0.233421	7.70865
Within Groups	0.000135	4	3.37E-05			
Total	0.000201	5				

As test statistic value is less than the F (1, 4) at 5% level of significance the factor **Sex is found to be not significant** with respect to both number and premium lapsed.

10. Factor: Rural/Urban

Using number of policies lapsed

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	0.000215383	1	0.000215	4.642053	0.097484	7.70865
Within Groups	0.000185593	4	4.64E-05			
Total	0.000400976	5				

Using premium lapsed

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	2.72E-05	1	2.72E-05	2.615307	0.181145	7.70865
Within Groups	4.17E-05	4	1.04E-05			
Total	6.89E-05	5				

As test statistic value is less than the F (1, 4) at 5% level of significance the factor **Rural/Urban is found to be not significant** with respect to both number and premium lapsed.

1. Combination of factors: Age group and Duration

Source of Variation	SS	df	MS	F	P-value	F crit
Between Age groups	0.02883	10	0.002883	8.254539	1.02E-07	2.026141
Between Durations	0.092989	5	0.018598	53.2492	7.43E-19	2.400412
Residual	0.017463	50	0.000349			
Total	0.139282	65				

As test statistic value is greater than the critical value of F-distribution at 5% level of significance the factors **Age group** and **Duration** are found to be **significant** with **Duration** being **more significant**.

2. Combination of factors: Duration and Premium paying term

Source of Variation	SS	df	MS	F	P-value	F crit
Between Durations	0.08623	5	0.017246	43.8917	4.16E-10	2.710891
Between Premium terms	0.003413	4	0.000853	2.171531	0.109312	2.866081
Residual	0.007858	20	0.000393			
Total	0.097502	29				

As test statistic value is greater than the critical value of F-distribution at 5% level of significance the factors **Duration** is found to be **significant** and **Premium paying term** is found **not significant**.

3. Combination of factors: Duration and Premium range

Source of Variation	SS	df	MS	F	P-value	F crit
Between Durations	0.104511	5	0.020902	27.39986	6.18E-12	2.449468
Between Premium ranges	0.012275	8	0.001534	2.011283	0.069869	2.180172
Residual	0.030514	40	0.000763			
Total	0.1473	53				

As test statistic value is greater than the critical value of F-distribution at 5% level of significance the combination of factors **Duration** is found **significant** but **Premium range** is found to be **not significant**.

4. Combination of factors: Duration and Agency

Source of Variation	SS	df	MS	F	P-value	F crit
Between Durations	0.251813	5	0.050363	7.610009	0.000381	2.710891
Between Types of Agency	0.128703	4	0.032176	4.861892	0.006655	2.866081
Residual	0.132359	20	0.006618			
Total	0.512874	29				

As test statistic value is greater than the critical value of F-distribution at 5% level of significance the factors **Duration and Agency** are found to be **significant with Duration being more significant.**

5. Combination of factors: Duration and Policy type

Source of Variation	SS	df	MS	F	P-value	F crit
Between durations	0.178937	5	0.035787	8.470917	4.33E-05	2.533554
Between policy types	0.157975	6	0.026329	6.232145	0.000247	2.420521
Residual	0.126742	30	0.004225			
Total	0.463653	41				

As test statistic value is greater than the critical value of F-distribution at 5% level of significance the factors **Duration and Policy type** are found to be **significant with Duration being more significant.**

6. Combination of factors: Premium term and Agency

Source of Variation	SS	df	MS	F	P-value	F crit
Between Premium terms	0.016459	4	0.004115	2.061099	0.133863	3.006917
Between Types of Agency	0.018625	4	0.004656	2.332242	0.100053	3.006917
Residual	0.031943	16	0.001996			
Total	0.067027	24				

As test statistic value is less than the critical value of F-distribution at 5% level of significance the factors **Premium term and Agency** are found to be **not significant.**

7. Combination of factors: Premium range and Agency

Source of Variation	SS	df	MS	F	P-value	F crit
Between Premium ranges	0.086809	8	0.010851	7.05729	2.4E-05	2.244398
Between Types of Agency	0.01619	4	0.004048	2.632431	0.05235	2.668436
Residual	0.049202	32	0.001538			
Total	0.152201	44				

Test statistic value for **Premium range** is greater than the critical value of F-distribution at 5% level of significance the factor is found to be **significant** but **Agency type** is **not much significant**.

8. Combination of factors: Agency and Mode

Source of Variation	SS	df	MS	F	P-value	F crit
Between types of Agency	0.044011	4	0.011003	2.169953	0.109511	2.866081
Between Modes	0.410908	5	0.082182	16.20782	1.95E-06	2.710891
Residual	0.10141	20	0.00507			
Total	0.556329	29				

Test statistic value for **Agency** is less than the critical value of F-distribution at 5% level of significance the factor is found to be **not significant** but **Mode** is found to be **significant**.

9. Combination of factors: Agency and Policy Type

Source of Variation	SS	df	MS	F	P-value	F crit
Between types of Agency	0.0109289	4	0.002732	1.29099	0.301439	2.776289
Between types of policy	0.2987712	6	0.049795	23.52851	6.04E-09	2.508187
Residual	0.050793	24	0.002116			
Total	0.3604931	34				

Test statistic value for **Agency** is less than the critical value of F-distribution at 5% level of significance the factor is found to be **not significant** but **Policy type** is found to be **significant**.

10. Combination of factors: Age and Premium range

Source of Variation	SS	df	MS	F	P-value	F crit
Between Ages	0.691173	10	0.069117	8.10174	6.78E-09	1.951221
Between Premium ranges	1.68744	8	0.21093	24.72464	1.09E-18	2.056375
Residual	0.682493	80	0.008531			
Total	3.061106	98				

Test statistic values for both **Age and Premium Range** are greater than the critical value of F-distribution at 5% level of significance combination of the factors is found to be significant.

11. Combination of factors: Premium range and Mode

Source of Variation	SS	df	MS	F	P-value	F crit
Between Premium ranges	0.440644	8	0.055081	5.57581	9.2E-05	2.180172
Between Modes	0.456099	5	0.09122	9.234186	6.63E-06	2.449468
Residual	0.395139	40	0.009878			
Total	1.291882	53				

As test statistic value is greater than the critical value of F-distribution at 5% level of significance the factors **Mode and Premium range** are found to be significant.

Preparation of Multivariate regression model and data requirements.

A. Preparation of the model

Let \hat{L}_{dmat} be the observed value of lapse rate at duration of 'd' years, with mode of premium payment 'm', age at entry 'a' and type of policy 't' then its theoretical model value L_{dmat} can be expressed as

$$L_{dmat} = \mu + \alpha_d + \alpha_m + \alpha_a + \alpha_t + \beta_{dm} + \beta_{ma} + \beta_{at} + \beta_{tm} + \beta_{td} + \beta_{ad} + \gamma_{dma} + \gamma_{dat} + \gamma_{mdt} + \gamma_{mat} + \delta_{dmat} + e$$

Where μ is the overall mean

α_d is the addition for duration 'd'

α_m is the addition for mode 'm'

α_a is the addition for age group 'a'

α_t is the addition for type of policy 't'

β_{dm} is the addition due to interaction of duration group and mode group

β_{ma} is the addition due to interaction of age group and mode group

β_{at} is the addition due to interaction of age group and policy type group

β_{tm} is the addition due to interaction of policy type group and mode group

β_{td} is the addition due to interaction of policy type group and duration group

β_{ad} is the addition due to interaction of age group and duration group

γ_{dma} is the addition due to interaction of duration group, mode group and age group

γ_{dat} is the addition due to interaction of duration group, age group and policy type group

γ_{mdt} is the addition due to interaction of mode group, duration group and policy type group

γ_{mat} is the addition due to interaction of mode group, age group and policy type group

δ_{dmat} is the addition due to interaction of duration group, mode group, age group and policy type group

'e' is the error term

Out of the above mentioned combinations, parameters need to be calculated only for those combinations which are found significant through ANOVA.

By minimizing the expression $(L_{dmat} - \mu)^2$, the value of error term 'e' can be minimized and which leads to expressions for the above parameters in terms of observed values of means for various combinations of the significant factors.

For example

- i) $\mu = \bar{L}$ mean of the values of \hat{L}_{dmat}
- ii) $\alpha_d = \bar{\alpha}_{d..} - \bar{L}_{dmat}$

where $\bar{\alpha}_{d..}$ is the mean of the values of \hat{L}_{dmat} for duration group d over mode groups, age groups and policy type groups and similar expressions can be found for other parameters.

B. Requirements to generate the model:

a. Data requirement:

Data with respect to various combinations of factors as above to reflect the interaction effects is required i.e. in addition to the single and two-factor data submitted, three-factor and four-factor data reflecting the interactions are required.

If there are 'k' number of age groups, 'l' number of duration groups, 'm' number of mode groups and 'n' number of types of policy to be considered and three years of observation period, then it results in data requirement as follows.

For each year both lapses and exposed to risk are required for $k + l + m + n$ number of single factor values, $k*l + l*m + m*n + n*k$ number of two factor combinations, $k*l*m + l*m*n + m*n*k + k*l*n$ number of three factor combinations and $k*l*m*n$ number if four factor combinations.

b. Purity of data:

Apart from the above, purity of data must be assured. Impure data causes many hindrances to the data analysis. For example, taking the present study, some companies' data showed more lapses than corresponding exposed to risk and largely inconsistent figures for some combination of factors. Unless rectified data is submitted, such outliers (largely inconsistent with rest of data) may have to be removed from the data under consideration. But such removal may result in loss of data which is detrimental to the reliability of the statistical results. (But allowing faulty data to continue would give distorted results.) It is necessary to obtain data from the companies with all the heterogeneities mentioned in 1.3.1 reduced to a minimum possible level which adds more value and reliability to the results of the study.

c. Statistical package:

A statistical package which enables automatic generation of multivariate model and calculation of model parameters may be more useful.

* * * * *