Risk Factors Affecting the Level of Expenses in U. K. Life Offices

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Summary

The paper demonstrates that although expenses are closely correlated to premiums when considering a life company as a whole, this is not necessarily true when considering particular lines of business. Any actuary interested in controlling risk for a life insurer cannot, therefore, ignore expenses.

The paper discusses twelve factors which could affect the level of expenses in a life office. Empirical conclusions are based on confidential expense data for 1986. Few numerical results can therefore be reported in detail.

Conclusions reached are that:-

a) the nature of insurance business differs considerably by line of business and that therefore different models are appropriate for each.

b) For certain lines of business there is greater correlation between expenses and the revenue premiums of the prior year than the current year. This has important implications for those studies on say economies of scale which are based on only one year's data.

c) Average size of new policy is an important predictor of the level of expenses only for certain lines of business.

One of the values of this paper lies in indicating that a direct survey of U.K. insurance companies could produce significant results regarding factors affecting expense levels. These results could be used, for example, to determine efficiency comparators by line of business. Such comparators are, of course, invaluable for monitoring degrees of risk.

Résumé

Les Facteurs de Risque Affectant la Niveau des Frais Généraux dans des Bureaux Britanniques d'Assurance sur la Vie

L'article démontre que bien que les frais généraux soient étroitement liés aux primes lorsque l'on considère une compagnie d'assurance sur la vie dans son ensemble, cela n'est pas nécessairement vrai lorsque l'on considère des secteurs d'affaires particuliers. Tout actuaire intéressé par le contrôle du risque pour une assureur sur la vie ne peut donc ignorer les frais généraux.

L'article discute douze facteurs qui peuvent affecter le niveau des frais généraux dans une compagnie d'assurance sur la vie. Les conclusions empiriques sont basées sur des données confidentielles de frais généraux pour 1986. Peu de résultats numériques peuvent donc être rapportés en détail.

Les conclusions sont les suivantes:

a) la nature des assurances diffère considérablement par secteur d'affaires; différents modèles sont donc appropriés pour chacun d'entre eux.

b) Pour certains secteurs d'affaires il existe un rapport plus étroit entre les frais généraux et les primes de revenu de l'année précédente que de l'année courante. Cela a des implications importantes pour les études traitant par exemple des économies d'échelle qui ne sont basées que sur les données d'une seule année.

c) La taille moyenne de nouvelles polices n'est un facteur important pour prédire le niveau des frais généraux que pour certains secteurs d'affaires.

L'un des avantages de cet article est de souligner qu'une enquête directe auprès de compagnies d'assurance britanniques pourrait produire des résultats significatifs du point de vue des facteurs qui affectent les niveaux des frais généraux. Ces résultats pourraient être utilisés, par exemple, pour déterminer l'efficacité des comparaisons par secteur d'affaires. De tels element de comparaison sont, bien entendu, inestimables pour contrôler les degrés de risque.

"The main question was what the real variables were. It had already been said that the expenses were inelastic. If an office did twice the amount of new business in one year than it had done the year before, did its expenses double? Probably not; what happened was probably near chaos in the office concerned. Equally, if its new business was halved, it did not halve its expenses but merely created internal consternation. Possibly, therefore, the real variables with which they were concerned were the history of the office, its prestige and its tradition, and also its agency system, none of which was conveniently expressible in terms of regression analysis" (Dyson and Elphinstone, 1959:232)

1. Introduction

The purpose of this paper is to give an indication of those factors which would affect the level of expenses of a United Kingdom Life Office.

Data is taken from that supplied to the ABI Inter Office Expense Investigation in 1985 and 1986. All data used except that splitting expenses by line of business could, however, have been obtained from published sources -albeit with much greater difficulty.

When lines of business are separated out full details of the results cannot be published, because of reasons of confidentiality (Refer to section 2).

Possible factors affecting expenses will be discussed in section 4.

Regression analysis is used in the hope of finding a series of proxies to expenses such that the risk of management considering them rather than expenses is reduced to a sufficiently low level that expenses can be ignored as a separate feature. It is shown that this is not possible using available data. Expenses cannot therefore be ignored by the actuary concerned with controlling risk in a life office.

2. General

A full account of the ABI inter-office expense investigation (IOEI), its origin and development is contained in a paper entitled "The Life Offices Association's Inter-Office Expense Investigation" which was presented to the Actuarial Profession in April 1986 in England and in October 1986 in Scotland (Luffrum, O'Leary and Shedden: 1986). This is a valuable paper for anyone interested in the work of the IOEI.

The ABI expense investigation commenced with a pilot study in 1970 to which 20 offices contributed. In recent years about 50 companies have contributed on a fairly regular basis. The precise figure varies from year to year as new companies join and older contributors are, for example, taken over. Of the approximately 50 companies contributing

to the survey, about 30 provide the additional information required for the 'expenses only' investigation in which commission and other expenses were separated out.

The ABI data were collected from a questionnaire distributed to life offices who had indicated a willingness to participate in a regular survey.

As part of the IOEI participating offices are required to allocate their expenses by line of business (lines of business are namely : ordinary individual business, self employed business, sponsored individual business, sponsored group business and annuity in payment). This data may not be revealed to individual member offices; contributors receive only aggregate information. The ABI decided to ask the Department of Actuarial Science Statistics, City University to undertake a research project using the data since it has the technical expertise and knowledge of the market as well as satisfying the problems of confidentiality. In order to maintain the confidentiality of the individual offices publication of the results of research (including this article) has necessarily been subject to the approval of the ABI.

2.1   Data

Problems relate to the underlying classification of the data by line of business. Such distinctions as that between self-employed and sponsored individual pensions, or between sponsored individual and sponsored group business, are not clearcut for every company. This provides problems also when analyzing DTI returns. There is even greater flexibility regarding the allocation of expenses between the various classes of business and between new business and renewals. For all purposes, these allocations were, until recently, totally at the discretion of the company. In March 1990, the Institute of Actuaries issued guidelines to its members regarding these divisions for official purposes (IA: 1990). The guidelines retain great flexibility for the company. In particular, by the nature of the business, overhead expenses tend to be a significant proportion of total expenses and their treatment will significantly affect the division.

The division of expenses has been further complicated by the Inland Revenue definition of acquisition expenses. For instance, new business processing expenses are treated as non-acquisition for tax purposes, but acquisition by the DTI. Presumably, this further variation in definitions will create more inconsistency between offices. Consideration has been given to the problems of comparability of expenses in G D Kaye (1989).

Despite the above comments, the IOEI has great value for inter-office comparisons, especially if the ratios are used to consider trends. A company's management should be interested primarily in whether its relative position has changed in respect of other companies in the

investigation rather than in its absolute position. The manager must of course be prepared to justify the absolute position of the company to its Board of Directors in any comparison.

One of the original purposes of the investigation was to enable offices to make inter-office comparisons: using expense ratios. These were ratios of actual to expected expenses.

"The expense factors are simply benchmarks, designed to reflect what may be regarded as the level of expense experienced by offices generally for the broad categories of business chosen for analysis. They do not themselves indicate desirable levels of expense..." (Luffrum, O'Leary and Shedden, 1986:3.3.1)

3. **Structure of companies contributing to IOEI**

For 1986 55 offices participated in the IOEI survey and it covered 74% of the total UK ordinary life assurance and annuity business of ABI member <u>and</u> non-member offices, as measured by premium income. Table 1 shows the structure of the IOEI in the manner it is normally presented.

3.1   1986 Structure of IOEI

55 offices participated in the 1986 survey and it covered 74% of the total UK ordinary life assurance and annuity business of ABI member and non-member offices, as measured by premium income.

The primary subdivisions of data are :

Table 1

(a) into type of company	No of Companies
mainly transacting traditional with-profits business	25
transacting both industrial and ordinary business	5
composite insurers	14
mainly transacting unit-linked business	12

(b) into types of sales force	No of Companies
broker	32
direct	23

For technical reasons only 46 companies have been used in the analysis for this paper and it should be noted that not all companies write all lines of business.

The following variable features will be considered for their effect on the level of expenses of a life office: average size of policy, branches and their location, commission, distribution systems, lapse rates, legal form of organisation, rate of expansion, service, size, staffing, target market, tax. Results cannot be presented in detail where results relate to individual lines of business as information relating to expenses by line of business is not publicly available and it would breach the confidentiality promised to contributing offices.

Variables will be considered individually to permit discussion. Where data was made available in the IOEI informed judgements can be made of the predictive ability of the separate variables.

To study many of the features referred to above, information not submitted to the ABI IOEI is required. This can be obtained from (a) DTI returns, (b) Annual Reports and Accounts and (c) direct survey of insurance companies.

G D Kaye (1989) explained the difficulty of comparing items extracted from DTI returns and annual reports. To extract information from such sources is further complicated by their physical availability. By now, even 1986 material (this study relates to 1980-86) has probably been archived by many companies. The third alternative - direct survey - is therefore the method most often used by researchers. In general, this method would require the permission of the ABI since many insurance companies on receiving a survey form from a new source would contact the ABI to enquire how it should be handled. To ensure a good response and for any results to be of use to the industry, the survey must relate to as recent a date as practical. A direct survey has therefore not been used for this report, but it is hoped to do such a direct survey at some time in the future.

4. Model

For simplicity a linear relationship is specified.

$$Y = B_0 + B_1 X + e$$

where e is random disturbance term. The underlying model used is ordinary least squares (OLS) regressing expenses as the dependant variable against revenue premiums as the independent variable. OLS is one of the most commonly used methods of regression analysis. One of the reasons for choosing OLS for this study is it robustness to slight violations of assumptions. For details of this and other technical advantages of this method refer to A. Koutsoyiannis (1972,48).

For all lines of business taken together the model is :-

Expenses   = 6,021,981 + .1685 Revenue Premiums + e
             (2,881,902)   (.0090)

For ease of reference, the standard error of each of the regression parameters estimated $\hat{B}_i(i=0,1)$ is shown directly below the corresponding parameter estimate.

Formally, we will test the hypothesis $H_0 : B_1 = 0$
against the
alternative $H_1 : B_1 \neq 0$.

We use a two tail test at the 5% level of significance. We are able to accept that the parameter B is different from 0 if the standard error of the estimate is less than half its numerical value. (The use of 1/2 is a rough approximation to 1/1.96: where 1.96 is the usual 95%critical value.) A two tailed test is used for consistency, because although expenses cannot fall as premiums increase, it may be possible for them to fall as other variables which could be considered later are increased. If, on the other hand, the null hypothesis is accepted, we conclude that the least squares estimate is not significantly different from zero. It can be seen that in our case both parameters are significantly different to zero.

The coefficient of determination (R^2) is the measure of the correlation between the observed Y values and the fitted Y values and for this model = .89.   The coefficient of determination is also, more importantly in this context, the fraction of the variation that is explained by the fitted equation.

Normally autocorrelation is only tested for in time series data but its presence in cross-sectional data would mean that the disturbance term associated with any company is not uninfluenced by the values for other companies. This might be spurious or indicative of

(a) errors in measurements of either X or Y or both
 or
(b) mis-specification of the mathematical form of the model.
 or
(c) it might reflect the operation of an omitted explanatory variable.

The Durbin-Watson test (DW) (Durbin and Watson,1950 and 1951) is the standard test for autocorrelation where small samples are involved.

The calculated DW statistic (d*) is first compared with the theoretical value (d) that it would assume if the null hypothesis that auto-correlation did not exist was true. To test for negative auto-correlation 4-d* is considered. The exact distribution of (d) is not known, but upper (d_u) and lower (d_L) bounds have been calculated for various degrees of freedom at both the 5% and 1% level of significance.

For a sample of 46 with 1 independent variable d_L = 1.48 and d_u = 1.57 at the 5% level. d*=2.06 and therefore no autocorrelation positive or negative exists.

Details of the regression equations for each line considered separately cannot be provided for reasons of confidentiality.(Section2). However, to facilitate comparisons the same functional relationship (linear OLS) has been used for each line of business and the R^2 statistics for each model are summarised in table 2. It can be seen from table 2 that linear OLS is not appropriate for each line, before further explanatory variables are added.

<center>Table 2</center>

		R^2
Ordinary individual	new	.57
	renewal	.87
Self employed		.55
Sponsored individual		.88
Sponsored group		.87
Annuities in payment		.65
All lines		.89

4.1 Average Size of Policy

It should be noted that R. R. Geehan (1977) assumes that average policy size is in fact correlated with company size.

The following regressors were added to the model for each line of business: average policy size defined as appropriate premiums divided by numbers of policies for (a) new business, (b) existing business and (c) both together as appropriate.

For all lines of business together the average overall size of a new policy is highly significant detailed results are given. The significance test on t shows the probability that the relevant parameter could occur by chance. Only results that could not have occurred by chance in more than 7.5% of cases will be reported upon.

Variables	B	SE (B)	t	Sig t
Average new policy size	-6671.18	1230.21	5.42	0.00
Revenue premium	.17	.01	22.23	0.00
Constant	18579862	3222095	5.77	0.00

Adjusted R^2 = .93(.89)   DW = 2.17

For new ordinary individual business, again the average size of a new policy is highly significant, but no other results were significant. The differences in character of the lines of business are highlighted by the above analysis. In particular it is interesting that average premium size as defined either by total premiums or renewal premiums is not significant when analyzing renewal ordinary business.

In summary : average new policy size is a significant factor affecting expenses of new ordinary individual business: expenses reducing as average size increases. The introduction of this regressor for average new policy size represented a considerable improvement in the model: adjusted R^2 went from .57 to .74. Average size is not significant for any other line, but because of the importance of ordinary individual business it is a significant factor affecting the expenses of all lines together. Total average policy size is not a significant factor for all lines together or for any other line for which data is available.

4.2   Branches and Location

It is often assumed that branch costs are normally treated as initial expenses. Results produced in a paper presented to the Institute of Actuaries cast doubt on this.

> "The most likely explanation is that branch costs are very inelastic and are much more closely related to the more stable in force items than to new business items. Shortly, branch organisations reflect more closely past, rather than current, new business. If this is true, offices are accepting inefficiency: they cannot perpetually change their branch organisations to match the fluctuating new business...." (Dyson & Elphinstone, 1959:220)

Studies in the related field of building societies (Watkins & Wright, 1985) have shown that the number of branches is an important variable when considering economies of scale and that many building societies have "over branched". The location of branches may also be important, because of the different levels of office staff costs and rents associated with location.   G D Kaye (1989) deals with some of the difficulties of measuring rent.

In this study, therefore, companies were subdivided according to the location of their head offices in 1986. The areas considered were Scotland, Greater London, elsewhere. The results were found to be not significant at the 5% level.

It is not possible from published sources to ascertain how branches of a life office are split by (a) administrative, (b) broker support or (c) agent sales. If the nature of the branches were known and the number of branches devoted to sales support could be entered as a separate variable, it is possible that more significant results could be derived.

4.3   Commission

A statistical analysis of the affect of commission was not undertaken since in 1986 there were in place commission agreements. It is essential that variables which could affect expense are controlled for or are included in the proposed model. In the field of life assurance an example of a controlled variable (albeit not totally controlled) would be commission. Because of the existence of commission agreements, an analysis of the reasons for differences in the levels of expenses between two companies selling similar products would not reveal commission as an important factor. With the final abandonment of such commission agreements on 31 December 1989 it could now be an important variable.

4.4   Distribution Systems

Primary marketing systems such as agent, broker, direct mail must be considered. Most organisations now use combinations of all these. The ABI IOEI data is out of date as regards distribution systems since data provided by offices normally relates to their circumstances in the year they entered the investigation. Suitable LAUTRO and other ABI data is confidential except at the aggregate level.

4.5   Lapse Rates

"It should also be noted that the probability of lapse may well depend on insurer and agent behaviour. Numerous observers have argued that poorly qualified agents or agents responding to the financial incentives provided by insurer commission scales may convince buyers to purchase policies which they cannot afford with the result that the policies soon lapse. A prevalence of poor quality sales of this type could cause an insurer to have a high lapse rate and a high cost product" (Berisford, 1984:p33)

Lapse rates should be considered in some manner. The difficulty arises in how to allow for them in view of the poor statistics available. The DTI returns do not provide adequate information.

4.6   Legal form of Organisation

It has often been contended that Industrial Insurance Companies have higher expense ratios than other forms of insurance companies and that mutual companies have lower ratios than proprietary companies. Dummy variables must therefore be allocated to the different forms of organisation to test whether the legal form of an organisation is a significant factor affecting expenses.

Table 3 shows the structure of companies by type of company subdivided by sales force and type of ownership (mutual/non-mutual). This is a more informative method of presentation than that in table 1.

Table 3

	MUTUAL		PROPRIETARY		TOTAL	
	BROKER	DIRECT	BROKER	DIRECT	BROKER	DIRECT
TRADITIONAL	11	4	7	3	18	7
INDUSTRIAL	0	1	0	4	0	5
COMPOSITE	1	1	10	1	11	2
LINKED	0	1	3	8	3	9

TOTAL NUMBER OF COMPANIES   55

Data in this form has not previously been available. In the case of subdivision by sales force, the information was available, but not used and in the case of ownership it is information obtained from other sources other than the ABI as it is not requested by the IOEI.

Using this form of presentation it is immediately clear that the type of sales force a company used was highly dependent on the type of company and ownership. Note, however that no companies have changed their classifications between 1980-1986.

Information provided to the ABI IOEI in respect of types of business was transformed from the categories provided to the ABI into only two categories: industrial, other. Regressions were made with dummy indicator variables separately for mutuality and whether a company's main business was industrial.

It should be noted that a company which declares its main business as industrial and is therefore classified as an industrial company only enters its non-industrial business into the IOEI. One would not therefore expect the fact that a company is classified as industrial to be a significant feature of the analysis of expenses since that portion of such a company's business with the special attributes of being home service is specifically excluded from the IOEI (ie. only the non-industrial business of a company which primarily sells industrial business is included in the IOEI.) This will also have implications for its classification by size, as industrial companies will therefore be treated as smaller than they would have if home service business were included.

4.6.1   Mutual/Non Mutual

The mutual/non mutual split was not significant except for renewal ordinary business, with proprietary being more expensive than mutual, at the 4% level. Again for reasons of confidentiality it is only possible to provide the affects on adjusted R^2.

Adjusted R^2 = .88 (.87)

4.6.2   Industrial

The fact that a company is industrial or not does not appear to be a significant factor affecting expenses, except for ordinary individual renewal premiums where it is significant at the 0% level and the adjusted R^2 increases from .87 to .89.

4.7   Rate of Expansion

Two methods were used to consider rate of expansion :-

(a)   expenses were regressed against previous year's premiums to investigate if a better fit was derived than using existing years.

All lines showed a highly significant relationship. That this is so is not surprising as one would expect a high correlation between the size of one year's premiums and the next. What is surprising is that a better relationship is shown for all-lines expenses with the previous year's premiums than with the current year's premiums. This could be explained by timing differences.

This relationship was hinted at by Dyson and Elphinstone (1959:232):the quotation which heads the paper. This is,however, the first time that it has been demonstrated empirically. This provides another indication that studies of economies of scale which rely on one year's data should be treated with caution.

Table 4 reproduces the comparative R^2 using 1986 expenses and premiums for 1985 and 1986 respectively.

Table 4

	Adjusted R^2	
	1985	1986
Ordinary Individual New	.57	.57
Renewal	.86	.87
Self employed	.50	.55
Sponsored individual	.91	.88
Sponsored group	.89	.87
Annuities in payment	.59	.65
All lines	.91	.89

(b)   a derived variable for existing years premiums divided over previous years premiums was included as a further regressor The main regressor was kept as 1986 premiums for consistency with other studies as well as other results in this report. This was done separately for new, single,renewal and all business.

For all-lines of business the effect of the rate of increase of all premiums was significant at 7%, but the R^2 was unchanged. The rate of increase of neither new nor single, renewal nor all premiums proved significant.

For new ordinary business, neither the rate of increase of new nor single premiums proved significant.

For renewal ordinary business, the rate of increase of renewal business was not significant.

For self-employed business, neither the rates of increase of new, single, renewal or all business proved significant.

4.8   Service Standards

A study conducted across several industries demonstrated that a company's competitive edge often depends less on the quantity and cost of the things it produces, than on their quality and the promptness with which they are delivered (Houlden and Woodcock, 1989). The amount and type of service provided within the life insurance industry undoubtedly varies and will affect expense levels. Level of service is extremely difficult to quantify.

In December 1989 a large firm of brokers (Burns - Anderson) conducted a survey of 45 of the biggest life assurance companies. The survey found a 56 working day difference between the best and worst performers in the issuing of a life assurance policy. No data has been provided in the IOEI which would enable service standards to be quantified.

4.9   Size

The effect of size was considered in detail in G D Kaye (1991). It showed that economies of scale of a moderate nature were available within the industry. It should, however, be noted that there are considerable fluctuations in the level of expenses between companies of comparable size.

4.10   Staffing

"Often large, relative size can provide an advantage, but large size is rarely an advantage for people-related activities, such as life offices". (Cason,1978:24). R.L.Cason (1978) states that the practical cost advantages achievable through specialisation are greatly over-rated if labour saving machinery is not a factor. Staffing is therefore an important variable when considering economies of scale. An area where diseconomies of scales exists may occur is in the area of communications within the company and problems with industrial relations. As companies increase in size, so the number of 'levels' of management increase. This problem is discussed in E.A.Nelson (1968). Some independent variables relating to staff levels and salaries should

be included. Information relating to senior management salaries is available in companies reports and accounts. Sometimes details are provided of the number of staff, but consistent information is not readily available. This is another area where a survey of offices is the appropriate medium to obtain relevant data.

4.11 Target Market

The American Council of Life Insurance testified in the Moss Report (1978) that price variations observed in the life insurance market are explained by the fact that "companies sell in many different markets and experience, therefore, difference results in mortality, lapse and average policy size". It may be that some companies sell low price policies to low cost buyers characterised by high average policy sizes and low probabilities of lapse and death at any given age, while other companies concentrate on high price buyers with high probabilities of lapse and death. Such segmentation of the market could be achieved by high minimum premiums, stringent underwriting and so on.

4.12   Tax

It may be that the tax position of a company may lead it to be less careful regarding expenses. Information on the tax position of a life company could be surmised by analyzing its DTI returns.

5.   Conclusions

Average new policy size is an important predictor of the level of expenses for individual life business.

A better fit of the underlying model was found for all-lines together, sponsored individual and sponsored group business when regressing current year's expenses against prior year's premiums rather than current year's premiums. This indicates that studies of economies of scale which rely on one year's data should be treated with caution.

Actuaries concerned with controlling risk within their organisations should consider in detail the breakdown of expenses, since a good fit of the regression model was not found for all individual lines of business. For example, expenses for Annuities showed great variability between companies and the R^2 for Annuities remained low even with the addition of available variables.

A direct survey of insurance companies, would facilitate investigation of factors expected to be important where data was not available. It would overcome the problem of confidentiality as the data would be supplied for the purpose of the analysis. Such a survey could easily be made international.

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