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Article abstract

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Risk Classification in Life Insurance: Current Controversies

by

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On trouve, dans le travail de M. David Cummins, un excellent aperçu de certains aspects de l'assurance sur la vie. Comment les assurés sont classés au point de vue de la tarification, en tenant compte du risque de mortalité que présentent la femme et l'homme ayant le même état de santé et les mêmes occupations; comment réagissent ceux qui prétendent qu'il n'y a pas lieu de faire une différence quelconque entre les sexes, tant au point de vue assurance-vie que rentes viagères? Et cela, même si la statistique reconnaît un taux de mortalité différent. Nous avons pensé que le lecteur lirait cette étude avec intérêt. Elle a été présentée à l'Université Laval au cours d'un colloque tenu à Québec les 13 et 14 mai 1980.

Introduction

Life insurance companies have long classified applicants for insurance according to the companies' assessment of expected mortality rates. Thus, older people pay higher rates for life insurance than younger people, males pay more than females, and those with heart disease or other major impairments pay more than those in good health. The companies also reserve the right to reject an application for insurance on the grounds that the applicant's probability of death is so high as to be uninsurable.

For many years, state laws not only permitted this practice but in fact encouraged it. The law generally holds that fair discrimination is permitted and only unfair discrimination is illegal. A classification system discriminates fairly if all individuals with similar characteristics pay the same rate, e.g., all male applicants age 35 with no serious health problems should be charged the same premium per unit of coverage. Fair discrimination implies that rates should reflect the expected loss and expense costs of issuing the policy. A classification system is unfairly discriminatory if rate differences exist which do not reflect loss or expense differences. For example, rebating, i.e., reducing the expense component of the premium for some policyholders but not for others, would be unfairly discriminatory.

Recently, the traditional rationale for classification and some of the principal classification factors have come under attack by legislatures and the courts. An important area of controversy involves alleged sex discrimination, e.g., giving female participants in a pension plan smaller monthly benefit payments in recognition of longer female life expectancy. Insurance companies have also been attacked for charging higher rates or refusing coverage for (a) genetic deficiencies affecting particular racial or ethnic groups (e.g., sickle cell anemia, which affects blacks); (b) handicaps such as blindness and mental retardation; and (c) other factors such as sexual preference, a criminal record, etc. While most of these challenges are motivated by a desire to achieve social equity, in some cases the implications of the proposed changes for the operation of the insurance markets and the effects that the changes would have on other policyholders have not been given adequate consideration. The purpose of this paper is to examine the issue of risk classification in life insurance, to set forth criteria for a valid classification system, and to evaluate some of the key arguments that have been used in the classification controversy.

Reasons for Classification

Insurance is based on the principle of pooling, i.e., every policyholder is charged a premium and the resulting pool of funds is distributed among those who incur losses. For example, consider a life insurance company that issues $1,000 one-year term insurance policies to 100,000 people. If the death rate per year is two per thousand (probability of death = .002), 200 deaths will occur during the year and the company will have to pay out 200 × $1,000 or $200,000. To obtain funds to make these payments, the company charges each policyholder an equal share of the total death claims. Thus, each policyholder pays \$200,000 ÷ 100,000 or \$2 for insurance coverage. By paying the premium of \$2, each member of the group has purchased a guarantee that the company will pay \$1,000 to his or her beneficiary if death should occur. Thus, the policyholder has reduced the financial uncertainty facing the beneficiary due to the contingency of premature death. The value received is the insurance company's promise to pay and the resulting reduction in financial uncertainty; it is not necessary to collect in order to benefit from the insurance coverage.

If insurance were compulsory and only one insurance company existed, classification of risks would not be necessary. Everyone would pay an equal share of the total claims each year regardless of his or her probability of loss. This, in fact, is precisely what occurs under many social insurance programs. For voluntary coverages provided in competitive insurance markets, on the other hand, classification becomes a necessity. If everyone were charged the same premium rate, those with low loss probabilities would be subsidizing those with high loss probabilities. People in the former group would be inclined to drop their coverage, while those in the latter group would demand more insurance than they would if coverage were priced fairly (this is the phenomenon of *adverse selection*). This process would lead to an increase in the average loss probability of the pool and to further withdrawals by the policyholders with relatively low loss probabilities. The ultimate result could be the insolvency of the pool. Thus, companies would be forced to adopt classification in order to maintain the economic viability of the pool.

The development of underwriting classifications in a free market is accentuated by competitive considerations. If no classifications or only crude classifications were in use, some companies would begin to offer lower rates to policyholders with lower loss probabilities. The motivation would be a desire to expand their market share and thus to increase profits at the expense of companies with less refined class systems. The latter companies in turn would be forced to adopt classification refinements or face the prospect of market decline and potential insolvency. The process would continue until all identifiable factors associated with loss probabilities had been identified and reflected in the class system.

In practice, there are limitations on the degree of refinement that can be achieved in an underwriting classification system. For example, information on certain factors may be too expensive or difficult to obtain. In this case, the cost of gathering the information might exceed the premium reduction that could be offered to those insureds not affected by the factor in question. Hence, no competitive advantage would be gained from knowledge of the factor and the system would not be revised. Another type of limitation on classification refinements is social acceptability, i.e., some factors may be deemed by society to be unacceptable even though they may be associated with demonstrable differences in loss costs. An example is the use of race as an underwriting variable.

A final reason for the development of underwriting classifications is the desire to achieve equity among policyholders. It may be considered inequitable or unfair for policyholders with widely differing loss probabilities to pay the same rate even if no adverse economic consequences result from this practice. Thus, companies may develop classifications in order to be perceived as fair by their policyholders. Certain types of classifications may be encouraged or prohibited by society through the legislative or judicial process in order to achieve equity goals which would not be realized through the operation of the insurance markets.

To summarize, there are three principal motivations for the development of underwriting classifications: (1) to prevent adverse selection; (2) to compete effectively; and (3) to achieve equity or fairness among policyholders.

Criteria for an Acceptable Classification System

In order to accomplish these goals, underwriting classifications must satisfy certain criteria. Most of these criteria are the subject of general agreement among the parties with an interest in the insurance markets. Others, however, are considered important by some groups but not by others. This section outlines the criteria which are mentioned most frequently and indicates briefly the areas where controversies have developed.

Separation. According to the separation criterion, classes should be sufficiently different in expected losses to warrant the establishment of separate premium rates. Separation between two classes is present if there is a practically and statistically significant difference between the mean or expected losses of the two classes. If adequate separation is present, the likelihood of misclassification is small, i.e., it is unlikely that a policyholder in one class will have an expected loss comparable to the majority of policyholders in some other class. Some degree of overlap between classes is inevitable; the separation criterion simply requires that the overlap be minimized.

Homogeneity. It would be impossible to design a classification system in which all policyholders in a particular class have exactly the same expected losses. The best that can be achieved is to design classes so that the expected losses of class members are relatively homogeneous. If this is done, the class system will be equitable and the likelihood that a competitor can further subdivide the classes will be small. Figure 1[1] illustrates homogeneous and heterogeneous classes. In case 1, the top panel in the figure, homogeneous classes are illustrated. Here the difference in expected losses between the best and worst risks in each class is relatively small and most policyholders in each class have approximately the same expected losses. In case 2, on the other hand, a wide

[1] Voir page 118.

divergence exists between the best and worst risks in each class. The separation criterion also is violated because a substantial amount of overlap is present between the two classes.

Feasibility. The information required to administer the class system should be reliable and obtainable at a reasonable cost. Some criteria, such as the number of miles driven in auto insurance, would provide excellent separation and a high degree of homogeneity but would be difficult for companies to verify without incurring unreasonably high costs. Likewise, until recently, smoking was viewed as unreliable for life insurance classification even though it has a major impact on the probability of death.

Incentive value. A good classification system should provide incentives for loss prevention. Thus, in fire insurance, premium discounts for devices such as sprinkler systems have encouraged policyholders to undertake loss prevention activities. Unlike the preceding criteria, incentive value is a desirable but not a necessary requirement for acceptable underwriting classification.

Social acceptability. Nearly everyone agrees that underwriting criteria should satisfy the criterion of social admissibility or fairness. At the present time, the following are broadly acceptable social considerations:

(a) the classification system should not discriminate unfairly among policyholders with similar expected losses,
(b) the system should not differentiate at all on the basis of race, color, religion, or national origin, and
(c) personal privacy should be maintained as much as possible.

The principal source of controversy is whether specific classification factors such as sex are or are not socially admissible.

In judging social admissibility, some critics of the present class system advocate the use of the criteria of *causality* and *controllability.* According to the former criterion, there should be a causal link between an underwriting factor and expected loss costs. It is not sufficient, according to this argument, merely to demonstrate a statistical linkage. This view holds that sex is inadmissible as a classification factor in auto insurance because it is merely a convenient proxy for causative variables such as number of miles driven and aggressive behavior. Since sex proxies rather than measures the underlying causal factors, those who are misclassified through the use of this variable have been treated unfairly. The proxy approach is thus equivalent to stereotyping and hence is inadmissible.

Most actuaries and underwriters do not believe that causality should be a criterion for admissibility. They argue that any classification factor will misclassify some policyholders and that it is no more or less unfair to be misclassified according to causal criteria than it is to be incorrectly classified by proxy variables. Maximum fairness is achieved by using variables which have the highest statistical correlation with expected losses. Thus, the admissibility criterion should be correlation and not causality.

The controllability argument holds that it is inequitable to use classification factors which are beyond the policyholder's control. Proponents of this view maintain that factors such as weight (for a particular height class) are controllable and hence admissable for life insurance classification. Other factors such as handicaps and sex are not controllable and hence are inadmissible. The controllability argument is perhaps the least persuasive used by the critics of the present classification system. Carried to its extreme, it would suggest that factors such as age and congenital heart disease are inadmissible even though they are clearly related to mortality rates and do not seem inequitable to most people. The controllability criterion seems to be more expedient than rational. Its widespread use to judge the fairness of underwriting factors would threaten the existence of the classification system in its present form.

Risk Classification in Life Insurance

The underwriting system presently in use by most life insurance companies in North America is the *numerical rating system*. This system, which was introduced in 1919 by Arthur Hunter and Oscar Rogers of the New York Life Insurance Company, is based on the premise that most underwriting factors have a measurable impact on the probability of death. Thus, mortality studies can determine the extra mortality that may be anticipated from each major factor, and these mortality figures can be assigned precise numerical values.

The system defines an average risk the rating of 100 percent. Positive values known as debits are added to the basic rating for unfavorable underwriting factors, while deductions (credits) are made for favorable factors. The final percentage rating for any particular applicant determines whether the company will accept that applicant for insurance and, if so, whether he or she will be charged a standard or substandard premium rate. Usually, risks with ratings up to 120 or 125 percent are issued policies at standard rates, while those with ratings over 500 or 1000 percent are considered uninsurable. In between are the various substandard categories. Some companies use as many as sixteen substandard classes, while others use as few as six.

Life insurance companies maintain extensive underwriting manuals which give debits for a wide range of medical impairments. Ratings also are assigned for personal factors such as drug and alcohol abuse, for certain occupations, and for dangerous hobbies. As an example of the ratings, consider Table 1[1], which gives the debits and credits for height and weight used by a major insurance company. For a male who is 5 feet, 10 inches tall, the table indicates

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[1] Voir page 120.

that the average weight is 170 pounds. A person of average weight would be given neither a debit nor a credit. A male of this height who weighs 230 pounds, on the other hand, would be given a debit of 40 points. If no other favorable or unfavorable factors are present, this individual would be given a mortality rating of 140 percent, 15 points above the upper boundary of the standard class.

The numerical rating system is not intended to apply as an absolute standard in life insurance underwriting. Rather, it is designed for use as a guide to be supplemented by the judgment of experienced underwriters. Reflecting this fact, many of the impairments listed in medical underwriting manuals are assigned a range of debit values such as 10 to 50 rather than a single numerical rating. The underwriter is free to assign an appropriate value from the range depending upon the facts of the case under consideration.

The system promotes consistency among underwriters and permits routine cases to be handled by underwriters without extensive experience or training. It is less helpful for substandard risks with high ratings (above 200 percent), and for these cases underwriting judgment plays a primary role. The system has been criticized for using out-of-date or sparse statistical data to arrive at some of the numerical ratings. In addition, its accuracy has been questioned for cases characterized by multiple medical impairments. For these cases, the appropriate total debit may be greater or less than the sum of the debits applying to the individual impairments, and the system provides little guidance in this regard.

Another problem is that ratings for some impairments are not statistically based but have been assigned on the basis of underwriting judgment. This feature has been the source of considerable criticism, and legislation or regulations have been promulgated in some states requiring that underwriting ratings not be used unless supported by valid statistical data. Company people point out that such requirements could have an adverse effect on insurance availability. They contend that there is little doubt that some impairments are related to higher mortality even though adequate statistical data have not yet been accumulated. Many companies would be willing to issue policies to people with these impairments on an experimental basis provided they can obtain a reasonable, judgmentally based increase in the premium. Writing policies on this basis would permit the companies to gather sufficient statistical information to revise the ratings for the impairment in the future. Laws requiring statistical justification for ratings require in effect that companies incur losses in order to obtain these data. Thus, such laws are likely to diminish the use of experimental underwriting and aggravate availability problems.

As an example of a potentially controversial factor, consider diabetes. The underwriting guidelines used by most companies for this impairment are quite complex, consisting of a basic rating supplemented by additional debits (and, in some cases, credits) for factors affecting particular cases. Usually, the basic ratings depend on the age of the insured and the length of time the disease has been present. The basic ratings for six major companies are summarized in Table 2 for a selection of age and duration ranges. The ratings range from 125 to 200 debit points. If these ratings are correct and if companies were required to accept diabetics at standard premium rates, the degree of subsidy provided to each case by those in the standard class would be significant. If substandard ratings also were permitted for other impairments, the subsidy could become noticeable in the aggregate.

112 *The Sex Discrimination Issue*

The underwriting factor which has caused the most controversy in recent years is sex. There is a clear and substantial difference in the mortality rates for males and females, and the difference in life expectancy is approximately seven years. Accordingly, females have long received lower annuity payments per dollar contributed and, since the 1950s, have been charged lower rates for individual life insurance.

Table 2

Diabetes Ratings Used by Six Major Companies
(Selected Ages and Durations)

Company	Age at Issue	Duration of Disease (Years)	Number of Debits
A	21-25[a]	6-10	200-150
	31-35[a]	6-10	100
B	20-24	7-12	200[b]
	30-34	7-12	200
C	20-34	[c]	150
D	21-25	6-10	200
	31-35	6-10	125
E	26-35	6-12	200
F	25-34	7-14	150

[a]Age at diagnosis.

[b]A flat extra premium charge of $7.50 per $1000 of insurance also is levied.

[c]Duration debits are assigned separately. No additional debits are assigned for duration of 10 years or less, 50 debits are assigned for durations of 11 to 15 years, etc.

Within the past five years, there have been a number of court cases argued in the United States charging that unequal benefits and/or contributions for female pension plan participants are unfairly discriminatory. In one key case, *City of Los Angeles, Department of Water and Power v. Manhart*, the U.S. Supreme Court ruled that an employer cannot require unequal pension plan contributions for similarly situated male and female employees. In other cases, the courts have ruled that pension plan benefits cannot be differentiated by sex. The Teachers Insurance and Annuity Association (TIAA), which manages the pension plans of most colleges and universities in the United States, has announced that it will shift to a unisex or merged gender mortality table for all benefits arising out of contributions made after the middle of 1980 (approximately). This is a major development because TIAA is the defendant in several of the key court cases and previously had vigorously resisted any movement to unisex tables. Although most of the court activity has involved pension plans, bills have been introduced in both houses of the U.S. Congress that would bar the use of sex (as well as race, color, religion, and national origin) as a classification factor in any type of insurance.

Because of the importance of the sex discrimination issue and its potential implications for deliberations involving other underwriting factors, it is of interest to review the major arguments that have figured in the debate. This section provides a brief summary of each of the major arguments. The reader should be aware that the issue is extremely complex and that it is not possible to convey fully the subtleties of the arguments in a brief summary. Thus, the following should be considered an overview or brief introduction to the topic. An effort is made to present both sides of each argument, and few of the author's own opinions have been expressed.

Equal Benefits or Equal Contributions. Federal law requires and neither side in the annuity controversy denies that men and women should receive equal pay for equal work. Nor is there any controversy regarding whether the economic value inherent in a pension plan constitutes compensation. The issue in the annuity controversy is the proper way to measure the value of this component of compensation.

The view of the proponents of sex differentiated benefits is that employer contributions are the appropriate measure of compensation. Thus, an employer who contributes equal amounts to a pension plan for similarly situated men and women is not engaging in discrimination. It is not discriminatory at retirement to provide differentiated benefits because the differentiation reflects statistically significant differences in mortality and the *present values* of the benefits of similar male and female employees are equal. Hence, female employees receive exactly the same economic value as their male counterparts and are not the subject of discrimination. In fact, any other approach would discriminate against males.

Economic theory provides some support for this viewpoint. The economic view is that labor is a factor of production and that firms should purchase this and other factors of production until the point where the addition to revenue resulting from the last unit of each input (the marginal revenue) is equal to the cost of that unit (the marginal cost). Clearly, the cost of the component of compensation represented by the pension plan is the employer's contribution to the plan and not the amount of the benefit that ultimately is paid to the employee. If men and women perform equally on the job, economic theory implies that the cost of a unit of male labour and a unit of female labour should be the same. If they are not, the firm has an incentive to hire male rather than female employees.

The opponents of sex differentiated benefits argue that actuarial present values are irrelevant to the female pension plan participant. Rather, the relevant measure of economic value is the amount of the monthly pension benefit received after retirement. This and not the actuarial present value determines the standard of living of the female participant after retirement, and a system which permits unequal post-retirement standards of living for males and females who have held equivalent jobs is unfairly discriminatory. In addition, as noted below, the opponents do not concede that sex differentiated mortality tables should be used to measure actuarial present values.

Proponents of sex distinct benefits counter the standard of living argument by pointing out that it amounts to the establishment of a needs test for retirement benefits. The application of a needs test is contrary to the concept of a capitalist economy where rewards are supposed to reflect one's contributions, not needs. Furthermore, if a needs test is to be applied, it makes no sense to limit the test to recipients of single life annuities. The plan participants who receive the lowest monthly benefit per dollar of pension plan contribution are those who elect joint and survivor annuities. The needs test approach would say that they should receive benefits at least equal to those of single life annuitants because their annuities are suporting two persons rather than one.

The fallback position for the opponents is to argue that the equal contributions v. equal benefits controversy tends to obscure the real issue, that is, why do equal contributions lead to unequal benefits? The answer is clear — unequal benefits result from the use of sex distinct mortality tables. Consequently, the more important question is whether the use of such tables should be permitted.

Individuals, Classes, and the Overlap Theory. The opponents of sex distinct benefits contend that the generalization that women live longer than men is true for women as a class, but is not necessarily true for individuals. No one can say for certain how long a particular individual will live. Thus, the treatment of individual women as if they definitely have longer life expectancies than the average male constitutes stereotyping and hence is unfairly discriminatory. As the Supreme Court noted in *Manhart*, "Even a true generalization about the class is an insufficient reason for disqualifying an individual to who the generalization does not apply."

To the proponents of separate mortality tables, this argument reflects a lack of understanding of the principles of insurance. They point out that in any class of insureds, including annuitants, it is impossible to determine a priori who will and who will not benefit from the insurance. Thus, in a group of life annuitants, some will die after receiving only a few payments, while others will survive to collect far more than their original contributions. This does not mean that the former group has been discriminated against unfairly. The classification process involves the separation of individuals into relatively (but not perfectly) homogeneous classes which are characterized by statistically significant differences in average loss costs. Equity requires only that the classification process be relatively accurate and that each person within a given class be treated the same. As sex is an accurate and stable classification variable, its use is sound insurance practice and should not be forbidden.

The opponents to sex differentiation do not concede that sex satisfies the statistical criteria for an acceptable underwriting factor. In particular, they contend that sex discrimination does not lead to classes characterized by adequate homogeneity. If one considers 100,000 males and 100,000 females reaching age 65 at the same time and evaluates the pattern of deaths predicted by standard sex distinct mortality tables, there is a significant amount of overlap between the deaths. This pattern is shown in figure 2[1]. The figure reveals that about 80 percent of the male deaths can be paired with female deaths that occur approximately contemporaneously. Hence, 80 percent of the females are discriminated against because 20 percent of the female deaths cannot be matched with male deaths.

The counter-argument is that the comparison is meaningless because it ignores basic insurance principles. The value received from an annuity is the guarantee that one cannot outlive one's annuity benefits. The value of that promise is bound up in the actuarial present value of the annuity, a figure which depends on sex in a statistically significant manner. The matching approach has no relationship to the risk transfer that is reflected in the annuity and thus has no meaning in insurance terms.

Even assuming that matching makes sense, other matching schemes exist which do not support the case for equal benefits. For example, one could match the first man to die with the first woman to die, the second with the second, and so on. The woman corresponding to each man is some distance to the right along the horizontal axis and thus would receive more total benefits if the periodic payments were equal. Also revealing is an overlap chart comparing deaths for a group of 100,000 males age 60 with a similar group age 65. Here, the over-

[1] Voir page 119.

lap is 81 percent. A similar result obtains when one compares females age 60 with females age 65.[1] If one accepts the overlap theory, it also would suggest that benefits should not be differentiated by age (e.g., in the case of early retirement), a proposition which has not been accepted even in government programs such as social security.

The more enlightened opponents of sex distinctions in annuities concede some of the deficiencies of the overlap theory. They conclude that "the argument's only valid implication for the attribution of group characteristics to an individual is both obvious and important: not all women live longer than all men, some women do not live as long as the average man, and some men outlive the average woman. This is why the Supreme Court felt that even if generalizations about a group were true, they should not be controlling."[2]

Analogies with Other Classification Factors. Two other important issues are raised by the opponents of sex differentiated benefits: (1) smoking and other health-related factors, which may be as important as sex in predicting longevity, are ignored in determining annuity benefits; and (2) factors that make sense actuarially are not necessarily supportable from the point of view of social equity. Like race, sex fails the latter test.

The counter-argument with respect to health-related factors is that information on these factors is unreliable at ages 65 and above and would be too costly to obtain. Utilizing medical underwriting in employee benefits plans would eliminate much of the cost savings which makes these plans attractive. Furthermore, any particular health factor is unlikely to lead to the same degree of differentiation as age and sex.

A recent actuarial article reveals a weakness in this argument. This article shows that underwriting in individual life insurance based on a simple application question dealing with smoking led to a substantial degree of separation between the mortality rates of admitted smokers and those claiming to be nonsmokers. The authors of this article conclude "that the mortality differentials between smokers and nonsmokers are large enough to validate the separate indentification of these two groups for life insurance underwriting purposes... the mortality differentials exceed those between males and females."[3] Although differences do exist between annuity underwriting and life insurance underwriting and the differential between smoker and nonsmoker mortality is

[1]Spencer L. Kimball, "Reverse Sex Discrimination: Manhart," *American Bar Foundation Research Journal* (Winter 1979): 122-123.

[2]Sydney J. Key, "Sex Based Pension Plans in Perspective: *City of Los Angeles, Department of Water and Power* v. *Manhart*," *Harvard Women's Law Journal* (Spring 1979): 9.

[3]Michael J. Cowell and Brian L. Hirst, "Mortality Differences Between Smokers and Nonsmokers," forthcoming in the *Transactions of the Society of Actuaries*, proof page 19.

less at advanced ages. These findings suggest that one cannot rely on casual statements about the impracticality of health-related underwriting factors for employee benefit plans.

With respect to the race issue, proponents of sex distinct benefits argue that race is not an unambiguous factor, as is sex. There are several races and numerous people of mixed blood in the American population, making any type of racial classification potentially inaccurate. Furthermore, there is strong evidence that racial differences in mortality disappear when socio-economic conditions are equalized. For sex, however, clear genetic and biological differences seem to exist, "in addition to some differences that are artifacts of the social structure."[4] The counter-argument, of course, is that the social unacceptability of neither race nor sex depends upon the accuracy with which these factors can be applied to any particular individual.

Conclusion

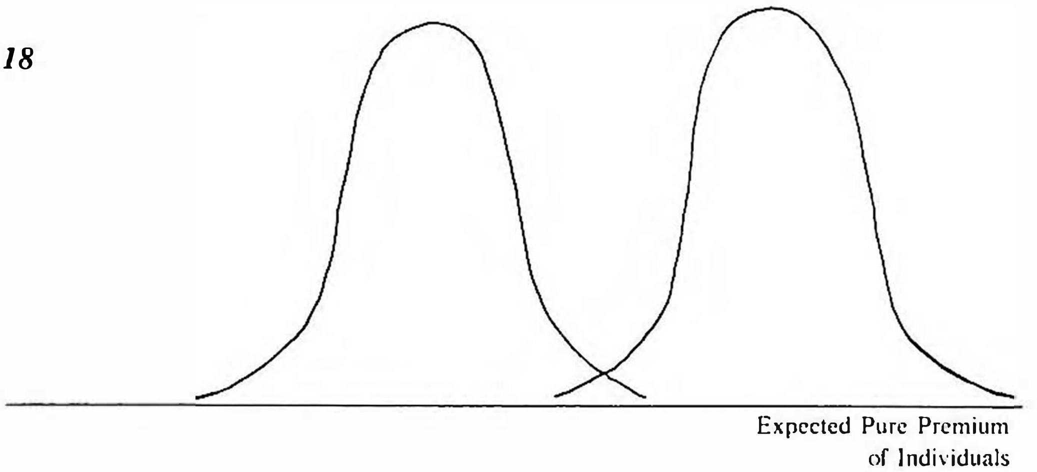
The issue of sex discrimination in pension plans is being resolved in favor of equal periodic benefits. However, the future of sex differentiation in individual life insurance, annuities, and other insurance products has yet to be resolved. Furthermore, there is no indication that the classification controversy will end when the sex issues are settled. Numerous legislative and regulatory actions already have been taken regarding the use of other types of classification factors such as genetic diseases and handicaps. If the sex controversy is any guide, these issues may be raised and resolved more rapidly than many have anticipated. In some cases, the insurance industry has been wrong, and certain factors should be eliminated from the underwriting process. In others, however, legitimate underwriting factors are at stake, the loss of which would destabilize insurance markets and jeopardize the private insurance industry in its present form. A prudent approach for the industry to take would be to eliminate voluntarily the suspect classification factors and to develop sound arguments for retaining those that are statistically and socially legitimate. As the sex controversy has demonstrated, actuarial arguments alone will not be sufficient.

[4]Kimball, *op.cit.*, p. 113.

Figure 1.

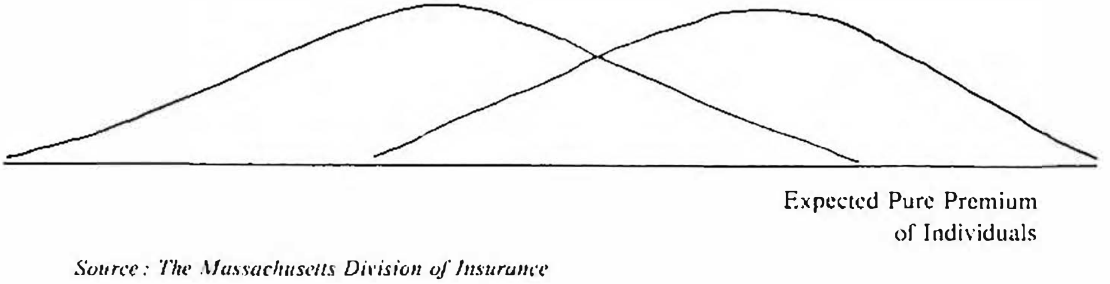
Comparison of Variance Between Homogeneous and Heterogeneous Classes

Case 1 : Low Variance and High Homegencity



Comparison of Variance Between Homogeneous and Heterogeneous Classes

Case 2 : Hight Variance and Low Homegeneity



Source : The Massachusetts Division of Insurance

Figure 2

MORTALITY DISTRIBUTION of 100 000 MALES and 100 000 FEMALES ENTERING at AGE 65

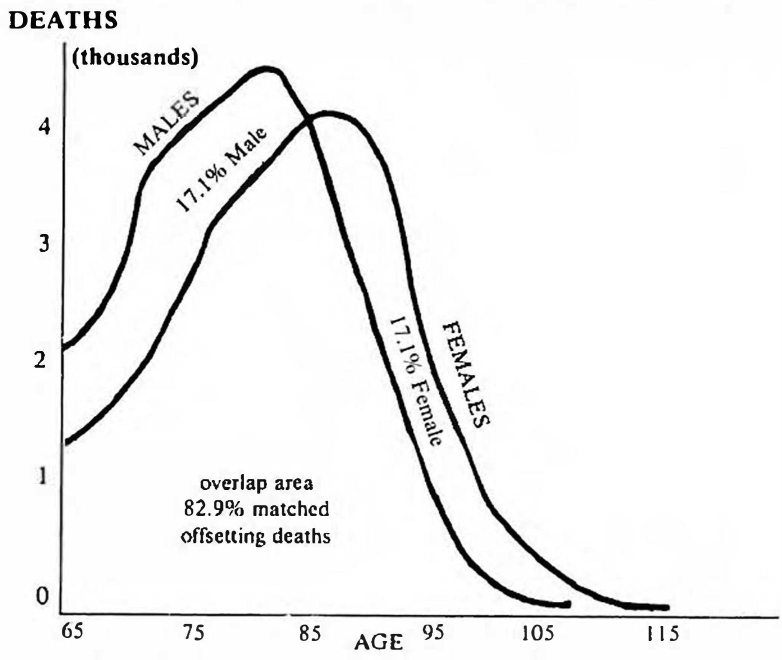


TABLE 1

LIFE INSURANCE BUILD CHART

MALES — AGES 18 AND OVER

Height Ft. In.	Underweight Percentages				"Ave" Weight	Overweight Debits																		Height Ft. In.
	30	20	15	10		10	15	20	25	30	35	40	45	50	60	70	80	90	100	125	150	175	200	
5- 0	92	105	111	118	131	151	155	160	164	169	173	177	181	184	191	196	202	206	210	218	225	233	240	5- 0
1	94	107	114	121	134	154	159	161	168	173	177	181	185	189	196	201	206	210	214	223	230	238	245	1
2	96	110	116	123	137	158	163	167	172	176	181	185	189	193	200	206	211	215	219	228	236	243	251	2
3	99	113	120	127	141	162	167	172	177	182	186	190	195	199	206	212	217	221	226	234	242	250	258	3
4	102	116	123	130	145	167	172	177	182	187	191	196	200	201	212	218	223	228	232	241	249	258	265	4
5	104	119	127	134	149	171	177	182	187	192	197	201	206	210	218	224	229	234	238	247	256	265	273	5
6	107	122	130	138	153	176	182	187	192	197	202	207	211	215	223	230	235	240	245	254	263	272	280	6
7	110	126	133	144	157	181	186	192	197	202	207	212	217	221	229	236	242	246	251	261	270	279	287	7
8	113	129	137	145	161	185	191	197	202	207	212	217	222	227	235	242	248	253	258	267	277	286	295	8
9	116	132	140	148	165	190	196	202	207	212	218	223	228	232	241	248	254	259	264	271	284	293	302	9
10	119	136	144	153	170	196	202	208	213	219	224	230	235	239	248	255	262	267	272	282	292	302	311	10
11	122	139	148	157	174	200	206	212	218	224	230	235	240	245	254	261	268	273	278	289	299	309	319	11
6- 0	125	143	152	161	179	206	212	219	225	230	236	242	247	252	261	268	275	281	286	297	308	318	328	6- 0
1	128	146	156	165	183	210	217	223	230	236	241	247	253	258	267	274	282	287	293	304	315	325	335	1
2	132	150	160	169	188	216	223	230	236	242	248	254	259	265	274	282	289	295	301	312	323	331	344	2
3	135	154	164	174	193	222	229	236	242	249	255	261	266	272	282	290	297	303	309	321	332	343	353	3
4	139	159	169	179	199	229	236	243	250	256	263	269	275	280	291	298	306	312	318	330	342	353	364	4
5	143	163	173	184	204	235	242	249	256	263	269	275	282	287	298	306	314	320	326	339	351	362	373	5
6	147	168	178	189	210	242	249	256	264	270	277	284	290	296	307	315	323	330	336	349	361	373	384	6
7	151	172	182	194	216	249	256	263	270	276	283	290	297	305	314	324	332	339	346	359	371	384	395	7
8	155	176	186	199	221	255	263	270	276	283	290	297	305	314	323	332	340	349	359	370	381	394	405	8
						10	15	20	25	30	35	40	45	50	60	70	80	90	100	125	150	175	200	

FEMALES — AGES 18 AND OVER

Height Ft. In.	Underweight Percentages				"Ave" Weight	Overweight Debits																		Height Ft. In.
	30	20	15	10		10	15	20	25	30	35	40	45	50	60	70	80	90	100	125	150	175	200	
4- 8	78	89	94	100	111	133	139	144	149	154	159	163	167	171	178	182	186	190	193	201	208	215	221	4- 8
9	79	90	96	102	113	136	141	147	152	157	162	166	170	174	181	185	189	193	196	204	212	218	225	9
10	80	92	98	104	115	138	144	150	155	160	165	169	173	177	184	189	193	196	200	208	215	222	229	10
11	82	94	99	105	117	140	146	152	158	163	167	172	176	180	187	192	196	200	203	211	219	226	233	11
5- 0	84	96	102	108	120	144	150	156	162	167	172	176	181	185	192	197	201	205	208	217	225	232	238	5- 0
1	86	98	105	111	123	148	154	160	166	171	176	181	185	189	197	202	206	210	214	222	230	238	244	1
2	88	101	107	113	126	151	158	164	170	175	180	185	190	194	202	207	211	215	219	228	236	243	250	2
3	90	103	110	116	129	155	161	168	174	179	185	190	194	199	206	212	216	220	224	233	242	249	256	3
4	92	106	112	119	132	158	165	172	178	183	189	194	199	203	211	216	221	225	229	239	247	255	262	4
5	94	108	115	122	135	162	169	176	182	188	193	198	203	208	216	221	226	231	235	244	253	261	268	5
6	97	111	118	125	139	167	174	181	187	193	199	204	209	214	222	228	233	237	242	251	260	269	176	6
7	99	114	121	128	142	170	178	185	191	197	203	209	214	219	227	233	238	242	247	257	266	274	282	7
8	102	117	124	131	146	175	183	190	197	20.3	209	215	220	225	234	239	245	249	254	264	273	282	290	8
9	105	120	128	135	150	180	188	195	202	208	215	220	226	231	240	246	251	256	261	271	281	290	298	9
10	108	123	131	139	154	185	193	200	207	214	220	226	232	237	246	253	258	263	268	278	288	298	306	10
11	111	127	135	143	159	191	199	207	214	221	228	234	239	245	254	261	266	271	276	287	208	307	316	11
6- 0	115	131	139	148	164	197	205	213	221	228	235	241	247	253	262	269	275	280	285	296	307	317	326	6- 0
1	119	135	143	152	169	203	211	219	228	235	241	247	254	261	269	276	281	286	295	305	316	326	335	1
2	123	139	147	157	174	210	218	227	235	242	248	254	261	269	277	283	288	291	301	315	325	335	345	2
						10	15	20	25	30	35	40	45	50	60	70	80	90	100	125	150	175	200	

JUVENILE TABLE — MALES AND FEMALES

Minimum, Average and Maximum Standard Weights

Ages 0-9				Ages 10-13				Ages 11-17			
Ht.	Min.	Ave.	Max.	Ht.	Min.	Ave.	Max.	Ht.	Min.	Ave.	Max.
24"	9	13	23	48"	45	56	90	54"	63	79	138
28"	13	18	31	50"	49	61	97	56"	68	85	146
32"	18	23	40	52"	54	67	104	58"	73	92	152
36"	23	29	48	54"	58	73	113	60"	79	100	160
				56"	63	79	123	62"	85	109	168
40"	29	36	59								
44"	35	44	70	58"	69	86	132	64"	91	117	179
48"	42	53	84	60"	74	94	141	66"	97	126	189
50"	46	58	92	62"	80	103	152	68"	104	135	199
52"	51	64	100	64"	87	112	162	70"	110	144	211
				66"	93	121	172	72"	117	154	221
54"	56	70	108								
56"	61	76	117	68"	100	130	182	74"	124	164	231
58"	66	83	126	70"	106	139	192	76"	131	174	241
60"	71	90	135	72"	113	149	201				

Outside these limits.......................PRN