

Disability and Life Insurance in the Individual Insurance Portfolio

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The "conventional wisdom" regarding the relative importance of disability income insurance compared to life insurance in the individual insurance portfolio is investigated. An expected value model is applied to actuarial data for insured lives to provide a direct comparison with respect to individual objectives. The results provide preliminary support for the dominance of disability over mortality objectives and raise questions about the financial planning techniques currently in use.

In the literature pertaining to personal financial planning, personal insurance, and employee benefits, "conventional wisdom" strongly suggests disability income insurance should take priority over life insurance when forming an insurance portfolio (Amling and Droms, 1986, p. 311; Beam and McFadden, 1985, p. 113; Rejda, 1986, pp. 430-31). The basic tenets of the conventional wisdom are: (1) the probability of an earner suffering a long-term disability (LTD) is greater than the probability of death at every age during the working lifetime, and (2) given that a loss occurs, the severity of an LTD loss exceeds the severity of a mortality loss because the family continues to incur personal care and other expenses related to the disabled earner. Statements of the conventional wisdom imply that income and other losses attributable to long-term disability are both more probable and more severe than losses caused by an earner's death.

Consumer behavior does not reflect the conventional wisdom. The 1986 *Life Insurance Fact Book* indicates that 81 percent of U.S. households owned life insurance in 1984, with a mean coverage amount of \$64,200. For the same year, the U.S. Department of Health and Human Services shows that only 21.9 percent of the working population carried LTD insurance.¹ Because

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¹ More recent surveys of household purchases of life and/or LTD insurance are not available at this time. The mean amount of life insurance per U.S. household had grown to \$87,600 in 1988 (1989 *Life Insurance Fact Book Update*, p. 22). U.S. holders of LTD insurance grew by 3.1 percent

consumer behavior has not responded to the conventional wisdom, an investigation of the relative value of LTD and life insurance to the individual is appropriate.²

The primary purpose of this study is to provide preliminary evidence on the basic issue of holding disability income insurance versus life insurance in the individual insurance portfolio. In the next section, a brief review of relevant research is provided.

Prior Research

The literature pertaining to LTD insurance is largely restricted to descriptive studies of products (Miller, 1978; Morris, 1986; Soule, 1984) and macroeconomic studies of demand or claims (Doudna, 1977; Rea, 1981). Researchers generally have not investigated rational purchasing behavior by individuals with respect to LTD insurance.

In contrast, programming models for determining family life insurance requirements have been developed by Belth (1964), Gustavson (1982), and Rose and Mehr (1980). Expected value models, impounding both income replacement and other anticipated needs conditional upon death of the earner on a certain date, are proposed in these studies³. The earner is assumed to make decisions in isolation, i.e. without consideration of liquidity constraints or needs for other types of insurance. Jenkins (1988) demonstrates that such models ignore bequest motives, but alternatives are not provided.

Statements of the conventional wisdom often are based upon loss data for insured lives generated by The Committee to Recommend New Disability Tables for Valuation (Disability Committee) (1985) and The Special Committee to Recommend New Mortality Tables for Valuation (Mortality Committee) (1981). These data were approved for ratemaking purposes by the National Association of Insurance Commissioners.

Table 1 contains disability and mortality incidence rates derived from data generated by the two committees. The data show that males and females in white-collar occupations are much more likely to become disabled than to die at every age during the working lifetime.⁴ This observation is even more apparent for blue-collar workers.

from 1985 through 1986, although holders of individual policies decreased by 6.3 percent (1988 Update: *Source Book of Health Insurance Data*).

²One feasible explanation for the low purchase rates for LTD insurance could be the perception by individuals that short-term disability (STD) insurance provided via employer or state-mandated programs will meet most of their needs. Price (1986) finds that nearly 60 percent of U.S. earners are covered by some form of STD plan, but less than half of those working in the 45 states without mandated STD have any coverage.

³The referenced models allow the death to occur either immediately or at the beginning of each succeeding year.

⁴The disability data reflect the experience of insureds holding policies with minimal elimination periods, as explained in Table 1. Data for holders of LTD policies with 90-day elimination periods also reveal substantially higher rates of disability incidence, although not of the magnitude shown in Table 1 (Disability Committee, p. 590).

Table 1
Basic Incidence Rates of Death and Disability

Age	Deaths Per 1,000 Insured Lives		Disabilities Per 1,000 Insured Lives ¹	
	Male	Female	Male	Female
25	1.08	0.53	106.57	116.02
35	1.18	0.82	112.75	155.38
45	3.19	2.37	122.71	181.64
55	8.28	5.26	144.65	179.82
62	15.95	8.33	169.65	209.31

¹Disability rates are for Class 2 insured lives holding policies with elimination periods of zero days for accident and seven days for sickness. Class 2 denotes supervisory, clerical, and technical occupations.

While disability losses occur more frequently than mortality losses, the relative severity of both types of losses also must be considered. When comparing income replacement objectives, for instance, the expected severity of disability losses may not exceed that of mortality losses because the disabled individual normally recovers or dies within a relatively short time. As shown in Table 1, approximately 123 of 1,000 males, aged 45 and holding policies with minimal elimination periods, will be disabled. Disability continuance data show that of these 123 initially disabled males, only 37 remain disabled after six months, however. The severity of disability-related income losses is relatively unlikely to be extensive, whereas mortality-related income losses are permanent.

The divergence of frequency and severity data demonstrates that rational models are necessary to determine whether an individual's disability objectives dominate his/her mortality objectives. The next section contains descriptions of the model and data used to test the comparative values of LTD and life insurance to the individual.

Research Design

Methodology

The model used to test relative objectives is based on an expected value criterion, following the previously cited studies of insurance programming. The model measures relative income and lump-sum replacement objectives for life and disability insurance, but does not provide estimates of absolute objectives or needs.

The expected value criterion implies a linear, or risk neutral, utility function on the part of the individual earner, while many insurance purchasing models are based upon risk averse utility functions (Beliveau, 1984; Campbell, 1980; Jenkins, 1988). Empirical evidence often does not support risk averse behavior by individuals, especially with respect to losses (Murray, 1972; Tversky and Kahneman, 1986). In light of uncertainty regarding functional forms of

individual utility, an expected value approach is feasible for providing preliminary evidence on the relative values of disability and life insurance.

A general model for the expected value of an individual's insurance objectives is expressed in equation (1). The individual is assumed to have constrained resources, hence the level of projected income replacement is a function of current earned income, net of taxes.⁵ The general model follows:

$$EVO_t = P\{L_t\} \left(LS_t + \sum_{h=0}^{N-t-1} \left\{ \left[\sum_{j=1}^{12} r I_t \left(\frac{1}{1+k} \right)^{j/12} P\{C_{t+h+j/12}|L_t\} \left(\frac{1+i}{1+k} \right)^h \right. \right. \right. \\ \left. \left. \left. - \left[\sum_{j=1}^{12} SS_t \left(\frac{1}{1+k} \right)^{j/12} P\{C_{t+h+j/12}|L_t\} \right] \left(\frac{1+COL}{1+k} \right)^h \right\} \right) \right) \quad (1)$$

where: EVO_t = expected value of objectives at age t ,

$P\{L_t\}$ = probability of loss occurring at age t ,

LS_t = lump sum objective, such as burial costs or estate taxes, necessitated by loss at age t ,

h, j = counted years/months of loss,

N = retirement age,

r = percentage of income replaced,

I_t = initial monthly income at age t ,

k = after-tax investment rate of return,

$P\{C_{t+h+j/12}|L_t\}$ = probability that loss continues to age $t+h+j/12$, given that the disability occurs at age t ,

i = annual income growth rate,

SS_t = social security benefit payable if loss occurs at age t ,⁶

⁵ Considering the low savings rates of U.S. households, this assumption may approach reality. For specific cases, projected income objectives are easily assessed via survey methods. Other objectives, such as those pertaining to incremental medical expenses or costs of lost employee benefits, can be added using individual loss expectations. While general data on these incremental costs are not available, inclusion of such costs would tend to increase disability objectives relative to mortality objectives.

⁶ The U.S. Social Security disability benefit is zero for the first five months following disablement. The benefit for subsequent periods is calculated according to computation rules applicable for the disabled earner and eligible family members. The definition of disability is extremely strict and the rejection rate is quite high compared to those for private insurers. Bound (1989) finds that less than half of the applicants rejected for Social Security disability benefits are able to work and that those returning to work are likely to earn less than comparable workers.

COL = annual cost-of-living adjustment rate for Social Security benefits.

The large summation term in equation (1) represents the present value cost of replacing a portion of the individual's expected income stream less the present value of Social Security benefits. The latter component easily can be expanded to include other sources of public or private insurance, if deemed appropriate for individual cases.

For mortality losses, the continuance probabilities must equal one, but are less than one for disability because of recoveries and deaths among disabled insureds. The inherently lower continuance probabilities for disability coupled with the relatively higher incidence rates shown in Table 1 mean that no *a priori* dominance of disability objectives is indicated by the mathematical model.

Data

The data generated by the Disability Committee and the Mortality Committee provide a unique opportunity to analyze actual loss data collected over comparable time periods. The Mortality Committee data encompass insured lives from 1970 through 1975. Total life insurance in force for the sample insurers averaged \$129 billion per year, approximately 14.3 percent of life insurance in force for the industry during the study period.

The Disability Committee data are for insured lives from 1973 through 1979. The data reflect 133,936 claims closed during the period, with over 60 percent closed during 1975 and 1976. Although the time periods for the two studies do not correspond perfectly, a significant intersection does exist and the periods correspond much more closely than do previous studies of actual loss experience for individual policies. Loss data generated for insured lives provide more comprehensive and detailed information than those available for the entire U.S. population. Some loss data are published by government agencies, but these data are reported in broad categories or are restricted to specific benefit programs.⁷

The disability data tested are for policies with elimination periods of zero days for accident and seven days for sickness. This type of disability policy is most comparable to a life policy, for which benefits are payable immediately upon loss occurrence. In effect, such disability policies provide both short-term and long-term benefits, but are best described as LTD policies because of benefit duration to age 65.

Initial input data for the comparative models are shown in Table 2. Sensitivity analyses were performed subsequently, with the results noted in the next section. Earners in younger age brackets are assumed to have children so that estimates can be generated with and without dependents' benefits

⁷Comparisons of disability experience for insured lives versus the general population are not available. The Mortality Committee (1981, pp. 631-4) does compare mortality experience and finds that mortality rates for insured lives are significantly lower than those for the general population.

provided by Social Security. Income replacement objectives are assumed to be lower for the family of a deceased earner because of the inherent reduction in personal care expenses. Income growth rates reflect a feasible earnings life cycle for a white-collar earner. Lump-sum objectives are accommodated via the burial expense input, initially set at \$5,000, with subsequent analyses showing that expected values are sensitive only to extremely high lump-sum inputs.

Table 2
Input Data for Initial Estimates

Occupation	Class 2 (Supervisory, Clerical, Technical)
Ages of Family Members (Insured, Spouse, Children)	25, 25, 1 35, 35, 8, 10 45, 45, 15, 17 55, 55 62, 62 65
Earners' Retirement Age	65
Initial Monthly Income	\$4,000
Income Replacement Ratios	
If Earner Dies	80%
If Earner Is Disabled	100%
Income Growth Rates (By Earner Age)	
25-40	8%
41-54	6%
55-65	4%
Discount Rate ¹	5%
Inflation Rate ¹	3%
Mean Tax Rate ²	30%
Social Security	Maximum for Age (1988)
Burial Expense	\$5,000

¹ Geometric mean returns derived from Ibbotson and Sinquefeld (1986).

² Reflects all federal, state, and local taxes.

For disability objective models, no allowance is made for possible workers compensation benefits or short-term disability benefits, although inclusion of these benefits is possible for individual cases.⁸ Initial results are discussed in the next section.

⁸ While workers compensation benefits are programmable, inclusion may not be rational because insurable losses are limited to job-related accidents or illnesses, whereas LTD and Social Security benefits apply to all causes of disability. Workers compensation benefits also are limited in terms of weekly maximum benefits, benefit duration, and total benefit amounts. For a summary of benefit limits by state, see U.S. Chamber of Commerce (1989). Limitations of state-mandated temporary disability plans and private, short-term disability insurance are discussed in Cox (1990, pp. 3-8).

Results for Expected Value Models

Strong assumptions about the probability components of the comparative model are posited initially and relaxed later to provide insight into the estimation process. The general model expressed in equation (1) is applied for both disability and mortality cases. Initially, incidence probabilities, $P\{L_t\}$, are set equal to one and observed continuance probabilities are used for $P\{C|L_t\}$. In other words, earners are assumed to die or to be disabled immediately and actual disability durations are applied.

As shown in Table 3, the expected value of disability losses are estimated at levels generally between 5 and 40 percent of mortality losses for individuals in the same age category.⁹ The lower magnitude of disability-generated losses is directly attributable to the very low probability of lengthy disability duration. This result conflicts with the second tenet of conventional wisdom, which posits that LTD losses are likely to be more severe than mortality-related losses. Disability continuance is a significant factor in determining loss severity, a fact generally ignored by financial planning authors and programmers.

Table 3
Expected Value of Objectivess Assuming Certain
Death or Disability With Continuance Factors Considered

Age	Mortality Need Male/Female	Disability Need			
		Without Social Security		With Social Security	
		Male	Female	Male	Female
25	\$2,797,482	\$126,601	\$129,161	\$107,798	\$110,607
35	1,539,354	134,201	128,647	110,864	106,847
45	873,528	120,121	118,755	98,491	97,681
55	391,336	91,713	87,014	68,016	64,766
62	118,952	48,792	43,576	38,238	34,495

The restrictive assumption that incidence probabilities are equal to one now is relaxed and the results are shown in Table 4. Actual data are implemented for mortality and disability incidence, as well as for disability continuance. Higher incidence rates cause the expected values of disability objectives to exceed mortality objectives at every observable working age. Comparing Tables 3 and 4, frequency factors are shown to dominate severity factors in terms of ultimate impact.

⁹Nearly identical results are obtained for discount rates of 2 and 8 percent, as well as for occupational class 1 (professional, technical, and managerial) and occupational class 4 (hazardous work with heavy manual labor or heavy equipment). Mortality needs continue to dominate when the income replacement ratio is varied between 50 and 90 percent, with the relative magnitude of dominance changing in the expected direction.

Table 4
 Expected Value of Death and Disability Objectives
 Considering Both Incidence and Continuance Factors

Age	Mortality Need		Disability Need			
			Without Social Security		With Social Security	
	Male	Female	Male	Female	Male	Female
25	\$3,021	\$1,483	\$13,492	\$14,985	\$11,488	\$12,833
35	1,970	1,262	15,131	19,989	12,500	16,602
45	2,787	2,070	14,740	21,571	12,086	17,743
55	3,240	2,058	13,266	15,647	9,839	11,646
62	1,897	991	8,278	9,121	6,487	7,220

The estimates in Table 4 demonstrate that males employed in a Class 2 occupation should expect disability objectives to exceed mortality objectives by four to eight times if no Social Security benefits are available. Comparable females have expected disability objectives seven to 16 times greater than those for mortality.¹⁰ One market study indicates that females purchase only 22 percent of all individual, noncancellable LTD policies (Edmonston and Scott, 1987). The results reported here conflict with such low purchase rates, especially when one considers the common use of unisex pricing for individual LTD policies.

Conclusion

The evidence provided in this study refutes the severity tenet of the conventional wisdom, but supports the dominance of disability over mortality objectives for earners subject to constrained resources. Disability dominance is a virtually consistent empirical finding independent of such factors as age, sex, and occupation for the data analyzed.

The study results raise questions about current financial planning techniques. Insurance programming models generally are restricted to estimates of expected severity under the strong assumption that losses are immediate and certain. The results of this research indicate that modelling limited to loss severity may bias planners' recommendations toward relatively greater holdings of life insurance in the earner's insurance portfolio. Better programming models must be developed by using a portfolio approach and impounding loss frequency information, which heretofore has been ignored in financial planning programs.

¹⁰For class 1 occupations, the disability objective is always at least twice the mortality objective for males and at least four times greater for females. For class 4 occupations, the relative level of disability dominance is much greater. Changes in discount rates and income replacement percentages affect the magnitude of disability dominance, but the disability objective always is twice that for mortality and, generally, reflects a much higher multiple.

References

- Amling, Frederick and William G. Droms, 1986, *Personal Financial Management*, Second Edition (Homewood, Illinois: Richard D. Irwin).
- Beam, Burton T., Jr. and John J. McFadden, 1985, *Employee Benefits*, First Edition (Homewood, Illinois: Richard D. Irwin).
- Beliveau, Barbara C., 1984, Theoretical and Empirical Aspects of Implicit Information in the Market for Life Insurance, *Journal of Risk and Insurance*, 51: 286-307.
- Belth, Joseph M., 1964, Dynamic Life Insurance Programming, *Journal of Risk and Insurance*, 31: 539-56.
- Bound, John, 1989, The Health and Earnings of Rejected Disability Insurance Applicants, *American Economic Review*, 79: 482-503.
- Campbell, Ritchie A., 1980, The Demand for Life Insurance: An Application of the Economics of Uncertainty, *Journal of Finance*, 35: 1155-72.
- Cox, Larry A., 1990, Disability Income Insurance and the Individual, Unpublished manuscript, The University of Georgia.
- Doudna, Donald J., 1977, Effect of the Economy On Group Long Term Disability Claims, *Journal of Risk and Insurance*, 44: 223-35.
- Edmonston, Barry and Pamela S. Scott, 1987, *The 1986 Disability Income Buyer* (Hartford, Connecticut: Life Insurance Marketing and Research Association).
- Gustavson, Sandra G., 1982, Flexible Income Programming: Comment, *Journal of Risk and Insurance*, 49: 290-96.
- Ibbotson, Roger G. and Rex Sinquefeld, 1986, *Stocks, Bonds, Bills and Inflation: 1986 Yearbook* (Chicago: Ibbotson Associates, Inc.).
- Jenkins, James W., 1988, Portfolio Motivations for Holding Life Insurance, Paper presented at the American Risk and Insurance Association annual meeting.
- Miller, John H., 1978, Disability Insurance: An Assessment of Its Social Value, *CLU Journal*, 32: 12-24.
- Morris, William H., Jr., 1986, *Disability Insurance* (Lexington, Kentucky: Lexington House).
- Murray, Michael L., 1972, Empirical Utility Functions and Insurance Consumption Decisions, *Journal of Risk and Insurance*, 39: 31-41.
- Price, Daniel N., 1986, Cash Benefits for Short-Term Sickness: Thirty-five Years of Data, 1948-83, *Social Security Bulletin*, 49: 5-19
- Rea, Samuel A., Jr., 1981, *Disability Insurance and Public Policy* (Toronto: Ontario Economic Council).
- Rejda, George E., 1986, *Principles of Insurance*, Second Edition (Glenview, Illinois: Scott, Foresman).
- Rose, Terry and Robert I. Mehr, 1980, Flexible Income Programming, *Journal of Risk and Insurance*, 48: 44-60.
- Society of Actuaries, 1985, Report of Committee to Recommend New Disability Tables for Valuation, *Transactions of The Society of Actuaries*, 37: 449-601.

- Society of Actuaries, 1981, Report of the Special Committee to Recommend New Mortality Tables for Valuation, *Transactions of The Society of Actuaries*, 33: 617-69.
- Soule, Charles E., 1984, *Disability Income Insurance: The Unique Risk* (Homewood, Illinois: Dow Jones-Irwin).
- Tversky, Amos and Daniel Kahneman, 1986, Rational Choice and the Framing of Decisions, *Journal of Business*, 59: S251-75.
- U.S. Chamber of Commerce, 1989, *1989 Analysis of Workers Compensation Laws* (Washington, D.C.: U.S. Chamber of Commerce).

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