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On the Rate Structure of the American Life Insurance Market

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ABSTRACT

This article re-examines the conclusion of previous studies that price dispersion is extreme in the American whole life insurance market. We take an axiomatic approach to the problem of measuring "price" dispersion in the market for the multiparameter whole life contracts, studying the distribution across contract offers of a price index which is uniquely determined by two conditions. In contrast to the accepted wisdom, we find that the derived measure of price dispersion is only 3.6% and that much of this dispersion can be accounted for by measurement error.

DURING THE PAST TWENTY years there has been a growing empirical literature on pricing in the life insurance market. The industry's apparent lack of price competition and its tremendous importance in the American economy[2] have motivated a number of investigations of the distribution of market prices [1, 2, 3, 8, 10]. The purpose of this paper is to reexamine the question that is central in these studies: is price dispersion large in the American life insurance market?

The basic products of the industry are introduced below. Section II of this paper briefly reviews the literature on the rate structure of this industry. Section III presents a simple analysis which derives, from a distribution of *contracts* across firms, a measure of *price* dispersion. Estimates of the derived measure are given in Section IV. Section V discusses some possible causes of price dispersion and estimates an upper bound to the extent of dispersion that cannot be attributed to measurement error or variation in costs across firms. The concluding section summarizes and contrasts the results of this paper with the conventional wisdom.

I. The Basic Product

The two most important products in individual life insurance are term insurance and whole life or permanent insurance. Whole life insurance can be carried for the entire life and is either nonparticipating, in which case the policyholder pays a constant annual premium, or participating insurance which is sold for a

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[2] Americans currently spend more than $90 billion annually, or more than 5 percent of personal disposable income, on products sold by the life insurance industry. There are more than $2.5 trillion of life insurance in force and the industry has grown to a size of more than $350 billion dollars in assets (*Life Insurance Fact Book*).

somewhat higher gross annual premium but involves a refund, called a dividend, to the policyholder at the end of each year. A participating policy is sold with a scale of dividends projected using the company's current cost position, but dividend projections are not guaranteed. Sixty-three[3] percent of life insurance sold in 1974 were participating.

Because the chance of death within a year increases with age, the cost of insuring an individual increases with the time a whole life policy has been in effect. In the early years the annual premium is much greater than the current cost of insurance protection. The excess is invested by the company to make up the deficiency in the later years of life, when the annual level premium is no longer sufficient to pay for annual cost of protection. A provision for *nonforfeiture*, a return of some part of the overpayments, is mandatory upon voluntary withdrawal from the policy. Usually this return is in the form of cash, and is called the cash surrender value. The cash value increases with the time that a policy has been in effect.

The *basic* whole life insurance policy is thus defined by a vector $(F, P; V_1, \cdots, V_T; D_1, \cdots, D_T)$ where

F is the face value

P the annual premium

V_t the cash value of year t; and

D_t the projected dividend of year t.

If $D_t \equiv 0$, the policy is nonparticipating. (The probability of survival beyond year T is assumed to be zero).

II. Previous Studies of the Rate Structure

The fact that the basic product is a contract and not a commodity with a "price" as such has been a complication in empirical studies of the life insurance industry rate structure. The approach taken in every study of the rate structure has been to define a "price" index, which summarizes the many contract parameters to a single dimension, and then to investigate the distribution of "prices" in the market. (A price index is a positive, real-valued function on the set of possible contract offers). The variation in the values of the index among the contracts offered in the market is taken as a measure of price dispersion.

More than a dozen different price indices have been employed in studies of the rate structure of this industry. In the seminal and most comprehensive study, Belth [1] demonstrated that there was a large variance in the *level prices*[4] for most policies, and that generally the variance was largest among those policies for which price comparison was most difficult. Belth concluded that price competition was ineffective in the American life insurance market, and was among the first to propose a comprehensive system of price disclosure as a step toward improving market performance. Belth's level price method has not attracted

[3] Huebner and Black [8], p. 532.

[4] Defined in Belth [1].

much interest in the disclosure movement—since it is *increasing* in cash values for certain values of the other parameters—but Belth [1] remains a standard reference on the industry "price" structure. Belth and Maxwell [4] reaffirmed the conclusion that price competition was lacking, in a study that considered twenty year *company retentions* as well as level prices. The company retention index is defined as *the expected present value of future premium payments minus future benefits.* Belth and Maxwell observed that the coefficient of variation of premiums was less than that of prices, from which they concluded that "premium competition" characterized the market more closely than did price competition.

The Senate Investigation of 1973–74 included in its report [7] an extensive listing of the relative price positions (by decile) of more than two hundred companies. Eight different price comparison methods were used in the listing, and a variety of other methods appeared elsewhere in the hearings. The price study which has received the widest publication to date is *The Shoppers Guide to Life Insurance* [10]. This study listed *interest-adjusted costs*[5] and purported to show that costs of insurance varied up to 170 percent. Another recent price study, Pritchett and Wilder [9], used the interest-adjusted cost index and *Scheel's Risk Premium* or *Policyholder's-Amount-at-Risk* method. In an attempt to explain price variation, the authors regressed company price positive (by decile) on various company characteristics. Finally, the Federal Trade Commission Staff Report on life insurance costs [5] used an internal rate of return index and concluded that the cost of similar life insurance policies varied widely across companies.

In summary, while there is much confusion over which price comparison method—if any—is appropriate for a study of the rate structure of the life insurance market, there is a consensus: that price competition is lacking in the industry, as evidenced by the large variation in prices.

III. Derivation of a Measure of Price Dispersion

The controversy over the issue of "measuring life insurance prices" warrants a careful justification of the empirical price dispersion measure which we will use in this paper. In contrast to the approach of simply defining a "price," the methodology adopted in this section to justify our measure of price dispersion is *axiomatic*: we impose, a priori, two axioms or desiderata on the concept of a price index and then show that under certain conditions the axioms uniquely determine a particular measure.[6]

Price variation in a perfectly competitive market is zero; a large price dispersion in the market for a homogenous commodity is sufficient (though not necessary) evidence of a deviation from competition in the market, specifically, of imperfect

[5] The interest-adjusted cost of a policy is defined as the present value of premiums paid minus benefits received by a consumer who enters a policy, survives, and surrenders after twenty years.

[6] The literature on the life insurance policy cost comparison problem has investigated (and often confused) two distinct issues: what is the extent of price dispersion in the market; and which is the "best" index for use in a disclosure programme. The author has elsewhere [20] provided an axiomatic justification for the retention index as a solution to the latter question as well as a defense of the index against certain criticism, such as in [15]. Only the first of the two issues is analyzed in this paper.

search on the part of consumers. In order for our measure of price dispersion to be a meaningful analogue, therefore, it must satisfy the *law of one price*:

A1: *In a perfectly competitive*[7] *market equilibrium, the variation in the index across contract offers would be zero (for arbitrary administrative costs).*

Variation in any index that does not satisfy A1 indicates nothing about the extent of price competition in the market or about the potential social benefits to a improvement in consumer information.

Clearly, the axiom A1 can determine the index at most up to a real-valued transformation. That is, if an index $I(\cdot)$ satisfies A1 then $f \cdot I(\cdot)$ also satisfies the axiom, for any $f: R \rightarrow R$. To choose a unique index, i.e., a particular normalization from among the family of indices determined by A1, it is necessary to impose another axiom.

The second axiom is based on the judgement that if insurance contracts were (hypothetically) completely standardized so that all contract parameters except the premium were identical across firms, then the variation in premiums would be an appropriate measure of dispersion. By "appropriate" is meant that a variation[8] in premiums alone of (say) 5 percent would be comparable to a 5 percent price variation in another market.

A2: *In a (hypothetical) life insurance market where policies differed only in the annual premium (all other contract parameters being identical) the index would equal the premium.*

As noted in Section I, a life insurance policy can be represented by a vector $x \in R^{2T+2}$. Let the *adjusted premium*[9] of a life insurance policy x be defined as the premium of that policy $\hat{x}$ which has expected benefits equal to the average benefits of all contracts in the market and the same retention as x. Benefits include the present value of dividends, face value, and cash value receipts. Algebraically, letting "$\overline{}$" indicate market average,

$$\text{EPV (adjusted premiums)} - \overline{\text{EPV (benefits)}} \equiv \text{EPV (premiums)} - \text{EPV (benefits)} \quad (1)$$

$$\text{Adjusted premium} = \text{Premium} + \frac{1}{a}\left[\overline{\text{EPV (benefits)}} - \text{EPV (benefits)}\right] \quad (2)$$

where a is the expected present value of one dollar paid annually while the policy is in force; and

EPV is "expected present value."

[7] The term "perfectly competitive" encompasses the assumptions of free entry on the part of firms and perfect search on the part of consumers. Specifically, a set of contract offers by firms and purchases by consumers is a competitive equilibrium if each consumer purchases the contract he prefers of all those offered, each firm offers a contract which maximizes profit given the offers of other firms, and each firm makes zero profit.

[8] As measured by the coefficient of variation.

[9] Not to be confused with the "adjusted premium" formula used in nonforfeiture regulation [8], p. 312.

The adjusted premium index adjusts the contractual premium to account for abnormal benefits; the variation in adjusted premiums is the variation in premiums which cannot be accounted for by variation in benefits. From (1), the adjusted premium is a transformation of the retention index:

$$\text{Adjusted premium} = \frac{1}{a}\left[\text{Retention} + \overline{\text{EPV (benefits)}}\right] \qquad (3)$$

Note that the adjusted premium index is *sample-dependent*; it is a function from the contract space onto R, for a given distribution of market contracts. To allow for a restricted form of sample dependency, an index I is now a function from R^{4T+4} to R, with $I(x_i; \bar{x})$ being the value assigned to contract x_i when the average values of the parameters in the market are $(\bar{x}^1, \cdots, \bar{x}^{2T+2}) \equiv \bar{x}$.

PROPOSITION: *Under the following conditions, the only index satisfying* A1 *and* A2 *is the adjusted premium index.*

a1: (*No adverse selection or variable probabilities*). *Rates of mortality and surrender experienced are the same for all firms and do not vary with the policy offered.*
a2: *Events of mortality and surrender are independent across consumers.*
a3: *Riskless bond markets are complete across time.*
a4: *Administrative costs are identical for all firms and independent of all contract parameters except the face value. EPV of average cost—which is a function, $C(q)/q$, of the quantity sold—reaches a minimum.*
a5: *Consumers preferences over the set of contracts are monotonically increasing in benefits and decreasing in the premium.*
a6: *Consumers each belong to one of a "small" number of groups, the members of each group sharing the same preferences.*

The assumption a1 of no adverse selection is necessary to ensure that the competitive equilibrium of A1 exists [14]. Assumptions a1, a2, and a3 allow us to reasonably assume that firms maximize the expected present value of profits.[10] a5 is an innocuous restriction on preferences. a6 is technically necessary to ensure that equilibrium contracts can be offered by more than one firm, i.e., to preclude monopoly power locally in the contract set.

Figure 1 depicts the competitive equilibrium under the assumptions of the proposition when there are two types of consumers. The contract is represented by a pair (P, V) where V is the cash value for one year; all other parameters are assumed fixed at equilibrium levels. The isoretention curves are linear and identical for all consumers by virtue of assumption a1. In the equilibrium, each consumer purchases the contract preferred of all those yielding zero expected profit, where profit is calculated at an average-cost-minimizing output quantity.

In Figure 2, the determination of the adjusted premium is represented geometrically, again in a two dimensional section of the contract space. The adjusted premium of any contract x is the premium of the contract, $\hat{x}$, at the intersection

[10] Formally, in an increasing sequence of economies or markets in which consumers are independently and identically replicated, firms would *asymptotically* maximize the EPV of profits. A proof would follow [11].

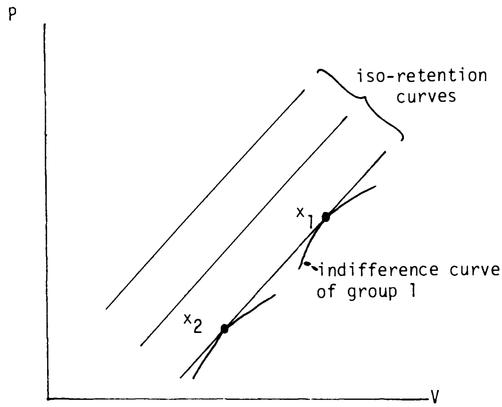

Figure 1. Equilibrium Contracts

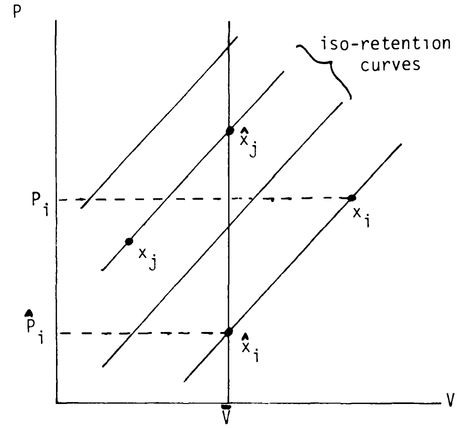

Figure 2. Adjusted Premium of x_i = *Premium of* $\hat{x}_i$

of the isoretention hyperplane through x with the one-dimensional, linear manifold obtained by fixing all contract parameters except the premium at the average level. P_i and $\hat{P}_i$ of Figure 2 are, respectively, the premium and adjusted premium of the contract x_i.

Proof of Proposition:

1. Any transformation[11] *of the retention index satisfies* A1:

Let $E(\cdot)$ be the retention index. The statement follows from the fact that each firm i will, in equilibrium, offer a contract x_i with $E(x_i) = \min_q \frac{C(q)}{q}$. If $E(x_i)$ were $< \min \frac{C(q)}{q}$ the firm would be incurring a loss. If $E(x_i)$ were $> \min \frac{C(q)}{q}$, another insurer could, by entering the market with a contract offer of identical benefits and slightly lower premium, attract an amount q^* of the consumer demand being served by the contract x_i, where q^* minimizes $\frac{C(q)}{q}$.[12] The economic profit for the entering firm would be positive, contradicting the supposition that the market was in equilibrium. Therefore the retention—and hence any transformation thereof—satisfies A1.

2. Any index which satisfies A1 *is a transformation of the retention index*:

Let $I(\cdot)$ be any index satisfying A1 and let x_1 and x_2 represent any two contracts for which $E(x_1) = E(x_2)$. For a cost function $C(q)$ such that $\min \frac{C(q)}{q} = E(x_1)$

[11] More precisely, "transformation of the retention index for fixed $\bar{x}$." $I(x_i, \bar{x})$ is such a transformation if $I(x_i, \bar{x}) = H(E(x_i), \bar{x})$ for some function H: $R^{2T+3} \rightarrow R$ where E is the retention index.

[12] Because of assumption a6, the minimum efficient size, q^*, of the entering firm is small compared to the existing quantity demanded of the contract x_i; the entering firm is therefore assured of sufficient demand to meet this minimum efficient size.

$= E(x_2)$ and for some preferences, x_1 and x_2 will be equilibrium contracts. (Fig. 1). This implies, by hypothesis, that $I(x_1; \bar{x}) = I(x_2; \bar{x})$ for any $\bar{x}$. Thus $E(x_1) = E(x_2) \Rightarrow I(x_1; \bar{x}) = I(x_2; \bar{x})$. This implies that $I \cdot E^{-1}$: $R \rightarrow R$ is a well-defined transformation for fixed $\bar{x}$; since $I(\cdot) = (I \cdot E^{-1}) \cdot E$, the statement is proved.

3. *The unique transformation of the retention index which satisfies* A2 *is the adjusted premium index*:

Let $(x_1, \cdots x_n)$ be an arbitrary set of contracts and let $\hat{x}_i$ be the contract with average benefits such that $E(\hat{x}_i) = E(x_i)$, as depicted in Figure 2. Let $I(\cdot)$ be a transformation of the retention index which satisfies A2. Defining $\bar{\bar{x}}$ as the vector of average parameters of the set $(\hat{x}_1, \hat{x}_2, \cdots, \hat{x}_n)$,

$$I(x_i; \bar{x}) = I(\hat{x}_i; \bar{x}) = I(\hat{x}_i; \bar{\bar{x}}) = \text{premium of } \hat{x}_i = \text{adjusted premium of } x_i \quad (4)$$

The first equality of (4) follows from $E(x_i) = E(\hat{x}_i)$ and the hypothesis that $I(\cdot)$ is a transformation of $E(\cdot)$; the second from the easily verifiable fact that $\hat{x} = \bar{\bar{x}}$; the third from the fact that all $\bar{x}_i$ have the same benefits and the hypothesis that I $(\cdot)$ satisfies A2; and the fourth from the definition of the adjusted premium index.

The proposition follows from the three statements proved. Q.E.D.

None of the assumptions a1 to a4 is completely realistic. However, it can be shown that each of them is *necessary* for the existence of an index satisfying A1; the lack of realism is a limitation of *any* study of the rate structure and not simply on the index used here.[13] In any case, the bias introduced by the empirical failure of these assumptions will be *against* the conclusion of this paper.

In an appendix, several common measures of price dispersion are criticized in the context of the theory of this section.

IV. Variation in Adjusted Premiums

Belth [3] lists the retentions of policies offered in 1970, for twelve different policies and about fifty of the largest companies. By a transformation of the retentions given by Equation (3), the distribution of adjusted premiums was obtained. The distribution so calculated depends on Belth's assumptions, which include a 5 percent discount rate.

The distributions of adjusted premiums are summarized in Table I. The coefficient of variation of adjusted premiums is only 3.6 percent on average, which is especially low in light of the following list of possible causes of the dispersion. The variation measured is not the variation in prices of a homogenous commodity; the causes listed are those which are related to this fact. The list may be interpreted as reasons why 3.6 percent is an *upward bias* measure of the "true"[14] price dispersion analogue in this market.

[13] The assumptions implicit in the use of previous indices are at least as strong as those stated explicitly here. For instance, if one *adds* the ad hoc assumption that the probability of death or surrender is zero until the twentieth year, when the probability of surrender is one, then the *interest-adjusted cost* satisfies A1.

[14] The "true" price dispersion is that which is not simply a reflection of variation in costs.

V. Some Possible Causes of the Apparent Price Dispersion

1. Measurement Biases

It is likely that for some policies not all of the contract parameters were captured in Belth's estimates of company retentions. There is a long list of secondary characteristics differentiating policies: for some companies, "age of purchaser" means nearest age—for other companies, age at last birthday; some refund part of the last premium paid when a policyholder dies; only some pay "terminal dividends" when a contract is terminated; some specify a short period of time within which the policyowner may withdraw with full refund of the premium, ad infinitum. Even the most careful estimate of future benefit streams is likely to miss some options.

Another measurement bias is introduced with the use of *twenty year retentions.* A twenty year retention, which is calculated with a surrender probability of one in the twentieth year, is equal to the full retention only if the twentieth year cash value is equal to the expected future benefits minus premiums discounted to that year. The variation in the difference of these latter two values across companies is a source of apparent, but not actual, variation in retentions.

Unless these measurement biases, or any of the other causes listed below, are strongly negatively correlated with the true adjusted premium—and there is no reason to expect this to be the case—they result in an overstatement of the price dispersion.[15]

2. Biases in dividend projections

The projected dividends which appear on contracts—and which were used in the calculations of retentions—are *not* estimates of future dividends, but rather the amounts which would be paid if the company did not change its dividend calculation formulae. The difference between the projected dividend and the actual future dividend does vary between companies. This difference may be known, up to some error, by consumers, since during their sales presentations, agents often use comparisons of the company's past projected dividend scales with past realized scales as an indication of conservatism in the projections. For participating policies, the variation in conservatism of dividend projections across companies is a second source of apparent but not actual price dispersion.

3. Variation in the mortality selection by companies

Variation in firm's mortality experiences (an element of product differentiation in the market) results from the fact that firms sell in a variety of socioeconomic and geographic areas, and from variation in the risk selection criteria.[16] Those companies selling to a high proportion of low income individuals have especially

[15] The variance of the sum of two random variables, which are in this case the true adjusted premium and the measurement error, is greater than the variance of the first random variable if the covariance is, in absolute value, less than twice the variance of the second.

[16] For example, one of the "low-priced" companies in our sample was known to reject about 15 percent of the applicants, whereas typically about 8 percent are rejected for application to the standard risk category. *Cf.* [7], p. 681.

high costs because of the inverse relationship of mortality and income (and, to some extent, because of the inverse relationship of withdrawal rates and income). The variation in mortality selection is potentially the most important source of dispersion and could certainly account for a large part of the variation observed.

4. Violations of assumptions a1–a6 *which are necessary to consider the dispersion in adjusted premiums as analogous to price dispersion*

One of these assumptions, for example, is that the selection of surrender probabilities is independent of the contract. There is some empirical suggestion, however, that policies with high early cash values experience a high lapse rate (as one would expect). Therefore, the retention of high cash value policies may be overstated.[17]

5. Variation in state tax rates on premium revenues

States tax premium income at rates varying from 1-¾ percent to 4 percent—a variation which should be reflected in premiums.

6. There may be a cost to changing rates

Firms do not change rates continuously, but instead adjust them every few years, usually in response to improved mortality experience. If there is a fixed cost to changing contracts, then it is incorrect to regard the observed distribution of adjusted premiums as an equilibrium distribution.

7. Variation in "service quality"

According to H. Denenberg, a common response of companies accused of high pricing was "we offer better service"[18] (i.e., more highly trained agents). This response held little apparent credibility in the light of previous purported demonstrations that price differences were as high as 170 percent, but could easily account for a significant proportion of the 3.6 percent variation estimated here.

8. Variation in rates of return earned on investments

Another possible, more subtle source of false dispersion is the variation in the expected rates of return on companies' investment portfolios. To the extent that capital markets are efficient, an insurance firm can earn a higher expected rate of return on its investment portfolio only by accepting greater risk. With the variation in the riskiness of companies' portfolios, another element of product differentiation is introduced into the market. A consumer may rationally choose to pay a slightly higher premium to buy from a company with a conservative investment portfolio: in so doing he avoids either some risk of low dividend, in the case of a participating policy, or the (remote) possibility of bankruptcy, in the case of a nonparticipating purchase from a stock company. Price dispersion due

[17] Also, the event of surrender is not independent across firms (Assumption a2) since the rate of surrender is known to vary with the unemployment rate. The unemployment rate is therefore a common factor of these events.

[18] H. Denenburg, testimony before the Senate Committee, [6], p. 1520.

to this or any other kind of product differentiation is not an indication of a lack of price competition.

9. Variation in state regulations

Firms licensed in New York are subject to certain limitations on expenses. A policy sold in New York is therefore differentiated from a policy sold in another state by the cost of provision.

Because the factors 1-9 above are causes of apparent, but not actual, dispersion in adjusted premiums, the 3.6 percent figure is an upper bound on the extent of price dispersion in this market. We next estimate a tighter bound on this quantity by determining, via linear regression, how much of the variation in adjusted premiums is accounted for by variation in certain of the quantities listed above.

The choice of which variables to include as regressors is limited by the availability of data. A list of the variables chosen follows:

Regressors

TXRT: The average state tax rate faced by the firm. This variable was calculated by dividing taxes and licensing fees by premium income for each company.

NY: Dummy variable indicating licensed in New York.

MORT: A dummy variable indicating "very favorable mortality experience" as rated by [5]. Best's rating is a very crude indication of mortality experience: of the 53 companies in the sample, 46 received the "very favorable" rating. (The remaining 7 received "favorable" ratings).

PRT: The rate of return earned on investments. This variable is also crudely measured as it is based on book values.

These data were obtained from [8]. The dependent variable, company retention (RET), was obtained from [3].

The full specification of the regression is as follows:

$$\text{RET} = a_0 + a_1 MORT + a_2 TXRT + a_3 NY + a_4 PRT + e. \quad (5)$$

Equation (5) was estimated for each of the twelve policies for which retentions are listed in Belth [3]. The results of the regression are reported in Table II. Most of the coefficient signs meet a priori expectations. The coefficient of the "licensed in New York" dummy is significantly negative at the 95 percent level in five of the twelve equations. The coefficient of the rate of return earned is also significantly negative in five of the twelve equations at the 95 percent level, and in seven of twelve at the 90 percent level. The premium tax rate is insignificant in all twelve regressions.

More important, for our purposes, is the percent reduction in price dispersion resulting from the regressions. The variation in retentions which is not accounted for by variation in the regressions, i.e., the standard error, is also listed in Table II. The percent reduction in dispersion, which equals $1 - \sqrt{1 - R^2}$ where R is the multiple correlation efficient, is modest in all cases.

Table I lists the variation in adjusted premiums not accounted for by variation in the independent variables in [5]. The average of this variation for the whole

Table I

Adjusted Premium Dispersions

No. of Firms	Policy Age	Policy Type[c]	Policy Amount	Mean *EPV* Premiums	Mean Retention	St. Dev. Retention	Coefficient of Variation	Adjusted[a] St. Dev.[b]	Adjusted[a] Coeff. of Var.
		Whole Life							
48	M25	Par	25th	4045.05	866.35	145.22	.036	124.15	.031
48	45	Par	25th	7384.83	1205.19	254.7	.034	194.01	.026
43	35	Par	10th	2232.07	480.81	88.81	.040	81.17	.036
48	35	Par	100th	21501.13	3940.31	700.97	.033	562.72	.026
22	25	NonPar	25th	3007.00	981.45	148.26	.049	144.62	.048
22	45	NonPar	25th	6121.04	1517.54	190.70	.031	180.75	.029
18	35	NonPar	10th	1796.44	612.67	37.37	.021	33.34	.018
22	35	NonPar	100th	16558.14	4608.63	693.41	.042	652.01	.039
		Term							
42	25	5 Year	25th	1518.05	760.43	128.69	.085	106.49	.070
43	45	Renewable	25th	3593.70	1156.67	230.06	.064	204.10	.057
40	35	Term	10th	826.15	422.15	65.76	.080	58.55	.071
44	35		100th	7162.60	3197.50	603.75	.085	560.78	.078

[a] Variation not accounted for by variation in regressors.
[b] Maximum Likelihood Estimate.
[c] Par ≡ participating; nonPar ≡ nonparticipating.

Table II

Results of Price Dispersion Regression[a]

No. of Firms	Age	Policy Type[c]	Policy Amount	C	NY	MORT	TXRT	PRT	Regression Standard Error	Percent Reduction in Dispersion[b]
48	25	Par	25th	1831.32	−117.08*	−143.14*	−3084.55	−127.04*	131.18	.15
				(336.81)	(49.91)	(58.16)	(2203.30)	(56.66)		
48	45	Par	25th	3084.78	−312.67*	−258.13*	−4189.92	−248.85*	204.98	.24
				(526.32)	(77.99)	(90.88)	(3443.03)	(88.55)		
43	35	Par	10th	967.43	−38.82	−86.81	−1478.12	−63.71	86.35	.09
				(234.46)	(34.55)	(44.04)	(1503.27)	(38.92)		
48	35	Par	100th	9426.45	−693.26*	−713.81*	−10948.64	−761.59*	594.54	.20
				(1526.56)	(226.20)	(263.60)	(9986.26)	(256.82)		
22	25	NonPar	25th	515.31	−24.50	−17.62	3473.32	73.70	164.52	.03
				(686.46)	(87.48)	(92.62)	(8258.63)	(97.19)		
22	45	NonPar	25th	931.17	46.36	71.83	12608.23	40.26	205.62	.05
				(857.95)	(109.33)	(115.76)	(10321.80)	(121.46)		
18	35	NonPar	10th	525.95	13.15	−25.33	2205.90	9.54	39.23	.11
				(178.50)	(21.19)	(23.16)	(2173.03)	(25.85)		
22	35	NonPar	100th	1623.22	−245.94	−3.36	40162.16	382.71	741.73	.06
				(3094.88)	(394.40)	(417.58)	(37233.97)	(438.16)		
42	25	5 Year Renewable	25th	1347.59	−136.40*	−72.23	−846.08	−77.55	113.65	.17
				(289.11)	(40.80)	(55.99)	(1917.22)	(48.26)		
43	45	5 Year Renewable	25th	2340.29	−49.97	−144.14	−1440.57	−182.58*	217.45	.11
				(546.04)	(77.50)	(106.99)	(3639.38)	(90.34)		
40	35	5 Year Renewable	10th	658.35	−49.55*	−24.16	−297.18	−32.86	62.71	.11
				(167.06)	(23.94)	(31.06)	(1059.36)	(27.82)		
44	35	5 Year Renewable	100th	6828.50	−234.79	−102.89	3030.40	−629.93*	596.54	.07
				(1493.08)	(211.66)	(274.26)	(9835.21)	(247.75)		

[a] Figures in parentheses under estimated coefficients are standard errors.
[b] Maximum Likelihood Estimate = $1 - \sqrt{1 - R^2}$.
[c] Par ≡ participating; nonPar ≡ nonparticipating.
* Significant at 95 percent level.

Table III
Price Dispersions in Other Markets[a]

Product	Mean Price	Standard Deviation	Coefficient of Variation
Boat	602.87	104.89	.174
Microwave oven	451.50	26.15	.058
Cameras	329.12	29.78	.090
Bicycle	144.77	6.34	.044
Calculator	123.44	12.77	.103
Office furniture	109.45	9.03	.083
Stationery	92.82	5.62	.061
Turntable	68.55	12.37	.180
Repair clarinet	44.28	13.78	.311
Skates	42.83	3.53	.082

[a] Pratt, Wise, and Zeckhauser [10].

life policies, 3.1 percent, is the basis for our empirical conclusion: that price dispersion is small in the U.S. whole life insurance market.

It should be emphasized that the estimate of 3.1 percent is an *upper bound* to the measure of price dispersion in this market. If more refined proxies had been available for use as regressors—the measure of mortality selection is so crude that it is insignificant in most of the regressions—and if the other causes listed had been quantifiable, the bound would have been tighter. In view of the causes listed, one cannot reject the hypothesis that the true price dispersion is much less than 3 percent.

In Table III, the dispersion of less than 3.1 percent in whole life insurance adjusted premiums can be compared with the estimated price dispersions of a wide variety of other markets reported in [10].[19] The upper bound of 3.1 percent dispersion estimated for whole life insurance is much smaller than any of the price variations reported for other products.[20]

VI. Conclusion

The evidence reported in this paper is inconsistent with the basic finding of the previous literature on the rate structure of the ordinary insurance market. For the sample of whole-life policies considered in [3] and reexamined here, the dispersion in adjusted premiums is very small.

The price dispersion is, interestingly, higher for term policies than for whole life policies. A commonly accepted wisdom has been that price variation persists in the whole life market because cash value policies are so complex that consumers

[19] Pratt, Wise, and Zeckhauser reported mean prices and standard deviations for 39 standard products; only the 10 most expensive are reported here. The products were randomly selected by PWZ from the Boston Yellow Pages. The exact specifications of the standard products are reported in [12]. The microwave oven, for example, is model RK4D, Amana.

[20] A limitation of the empirical results in this section is that the data are from 1970. An update would require a survey of life insurance companies, since information provided in rate manuals is incomplete.

are virtually unable to compare policies. The evidence here—that price dispersion is much less for whole life policies than for the simple, one-parameter term insurance contracts—is inconsistent with this hypothesis. It *is* consistent with the hypothesis that consumers devote less effort to search in the market for term insurance because term is a much smaller investment than whole life, and the returns to search in the term insurance market therefore less than in the whole life market.

While the results of this paper suggest that the extent of price dispersion in the whole life insurance market is not an indication of market failure, they do not prove in any way that the performance of the market is acceptable or could not be improved upon. What is recommended is a shift in the focus of empirical studies away from the extent of price dispersion to other indicators of market performance.[21]

Appendix

Previous Measures of Price Dispersion

In this appendix, I provide a brief critique of several of the most common measures of "price dispersion" in the life insurance market. The measures considered are the variations in the *Linton yield* (or average annual rate of return), the interest-adjusted cost index and the retention index.

The Federal Trade Commission Report [5] contrasted the large variation in Linton yields of similar life insurance policies with the small variation of rates of return within the banking industry. The Linton yield can be defined as follows: let an individual enter a whole life policy with conditional surrender probabilities of (0, $\cdots$ 0,1) for T years.[22] The Linton yield, LY_T, is the rate of return on a savings account necessary to equate the individual's returns from a combination of the savings and term insurance, across states and time, with the returns from the whole life policy. The rate so-defined depends on the term premium assumed for each year. LY_T is usually thought of as the rate of return paid on the "savings portion" of a whole life policy.

A competitive equilibrium, even under assumptions a1–a6, p7 would exhibit a variety of LY_T's across policies, for any T. *If* (1) all consumers had surrender probabilities of (0, $\cdots$ 0,1) and (2) the difference between the term premium assumed for any year and the *actuarially fair* premium in that year were equal to the whole life policy's administrative cost for the year, *then* under a1–a6 the LY_T of any equilibrium policy would equal the risk free rate available to firms on assets of maturity T. Only in this peculiar situation would the variation in LY_T be zero.

A whole life policy can be viewed as a combination of "pure" life insurance and insurance against the (possibly endogenous) events of withdrawal from the policy. In a competitive equilibrium [18, Section 4.2] one would expect to see a variation in cash values and premiums. Those policies with a high *T-th* cash value and

[21] Winter [19], for example, offers evidence that price rigidity in the response of the market to rising interest rates is a much more important problem than price dispersion.

[22] The conditional surrender probability is the probability of surrender during a year conditional upon survival and persistence to the beginning of the year.

high premium would have a high LY_T, as defined above.[23] This is not to say that the actual variation in LY_T is *necessarily* a reflection of variation in consumer preferences, but since this possibility cannot be entirely ruled out the variation in LY_T indicates nothing analogous to price dispersion in the market.

There *is* one internal rate of return which satisfies the condition in A1 for a particular, known set of annual administrative costs (although not for arbitrary costs, as does the retention index): the internal rate of return of the stream of expected premiums - benefits - administrative costs, where the administrative costs are evaluated at the efficient firm size. If the maturity structure of administrative costs were known precisely, this rate could be calculated. Given the empirical results of Section IV of this paper, it is almost certain that this internal rate of return would vary little over the sample of policies examined.[24] In any case, the normalization A2 is more meaningful for comparison with dispersion of *prices* in other markets; for comparison with dispersion of rates of return in other financial markets the rate of return defined here would be useful.

The most popular index is the *interest-adjusted cost index* (IAC), which can be defined as the present value of premiums minus benefits, for an individual with zero probability of death and probabilities of withdrawl equal to (0, $\cdots$ 0,1).[25] Whatever the index's appropriateness in a price disclosure movement, the IAC violates A1. The variation in the IAC is an ad hoc measure of price dispersion.

The *retention index* does satisfy A1. However, it is difficult to judge the significance of a given variation in retentions; the coefficient of variation of retentions may be large simply because the mean retention is very small.[26] The retention is more closely analogous to the absolute markup of price over certain costs than to a price in other markets, since it is the difference between (discounted) payments by consumers and benefits costs paid by firms. In a market where both price dispersion and the average markup over a common factor cost were small, the variation in markups could be very large. It is easily verified, from Equations (2) and (3), that

$$\text{Coefficient of Variation (Adjusted Premiums)} = \frac{\text{Standard Deviation (Retentions)}}{\text{Mean (Premiums)}} \tag{6}$$

[23] The tradeoff between a high cash value and low premium that a consumer would face in a competitive market would depend, in part, on the probability of surrender which would be *less* than one.

[24] This variation cannot be determined, however, without information on administrative costs. Some idea of the extent of variation of this rate of return in the market is gained by noting the following: a difference of 3 percent in prices of a (couponless) 25 year bond corresponds to a difference in yields of about .12 of one percent, when the yield is between 4 and 10 percent.

[25] The IAC has been endorsed for use in disclosure by several industry committees. The American Council of Life Insurance estimates that companies selling over half the U.S. life insurance either now provide, or will soon provide, with their policies summaries that contain the surrender index [5], p. 153.

[26] This point may be clarified by an example: suppose that because of a variation in the selection of mortality risks across firms, there is a variance in the premiums and *measured* retentions across firms and that this is the only source of variation. Let the *true* retention be identical across firms. To consider the problem when the retention is very small, let the true retention $\rightarrow 0$. If the mortality rates used in the calculation of the retention are representative, the average measured retention will also $\rightarrow 0$. The measured coefficient of variation of retentions will $\rightarrow \infty$, while the true dispersion remains at zero.

Thus, if one accepts the normalization A2, the coefficient of variation of retentions overstates price dispersion by a factor [mean (premiums)/mean (retentions)], which is typically between 4 and 5, for a Male-Age 35 policy.

REFERENCES

1. Joseph Belth. *The Retail Price Structure in American Life Insurance.* Bloomington, Indiana: University of Indiana Press, 1966.
2. Joseph Belth. "The Relationship Between Benefits and Premiums in Life Insurance." *Journal of Risk and Insurance* 36 (March 1969), 19–39.
3. Joseph Belth. *Life Insurance: A Consumers Handbook.* University of Indiana Press, 1973.
4. Joseph Belth and W. D. Maxwell. "The State of Competition in the Life Insurance Industry." *Antitrust Bulletin* 15 (Summer 1970).
5. Federal Trade Commission Report. *Life Insurance Cost Disclosure.* June 1979.
6. *Best's Insurance Reports.* Life-Health Edition, 1970.
7. The Life Insurance Industry: Hearings Before the Subcommittee on Antitrust and Monopoly of the Committee on the Judiciary, U.S. Senate 93rd Congress, 1st Session February 1973, Parts 1–3; 2nd Session July 1974, Part 4.
8. Samuel Huebner and Kenneth Black, Jr. *Life Insurance*, ninth ed. Prentice Hall, 1976.
9. *Life Insurance Fact Book.* New York: Annual, Institute of Life Insurance.
10. *Life Reports.* 1970.
11. E. Malinvaud. "The Allocation of Risks in Large Economies." *Journal of Economic Theory*, 1972.
12. John W. Pratt, David A. Wise, and Richard Zeckhauser. "Price Differences in Almost Competitive Markets." *Quarterly Journal of Economics* 93 (May 1979), 189–212.
13. S. T. Pritchett and R. P. Wilder. "Company Characteristics and Policyowner Cost Structures for Cash Value Life Insurance." *Journal of Risk and Insurance* 44 (September 1977).
14. M. Rothschild and J. E. Stiglitz. "Equilibrium in Competitive Insurance Markets: The Economics of Imperfect Information." *Quarterly Journal of Economics* 40, 626–49.
15. W. Scheel. "Company Retention—An Unreliable Indicator of the Cost of Life Insurance to the Policyowner." *Journal of Risk and Insurance* (March 1975), p. 81.
16. *Shoppers Guide to Straight Life Insurance.* Penn. Insurance Dept., June 1973, and later editions.
17. Society of Actuaries Committee on Cost Comparison Methods and Related Issues: Analysis of Life Insurance Cost Comparison Index Methods. Chicago, Ill., September 1974.
18. Ralph A. Winter. Information and Regulation in Life Insurance. Unpublished Ph.D. Dissertation: Berkeley, 1979.
19. Ralph A. Winter. "Regulation and the Response of the U.S. Life Insurance Industry to Rising Interest Rates." Institute for Policy Analysis Working Paper: Toronto, 1980.
20. Ralph A. Winter. "On a Bounded Rationality Problem in Life Insurance." Ms: 1980.