2nd AFIR Colloquium 1991, 4: 201-225

Implications for Life Insurance in Israel of the Break from an Index-Linked Economy

Jason S. Propp (1) & Michael Rosenblatt (2)

(1) Zion Insurance Co Ltd, 23 Yavne Street, Tel Aviv 65792, Israel
(2) Menorah Insurance Co Ltd, 73 Rothschild Blvd, Tel Aviv 65786, Israel

Summary

Over 30 years ago, due to an urgent need to raise very large sums of capital to finance immigration and industrial development, the Israeli Government established Index Linked Bonds as investment vehicles for Pension Funds, Bank Savings plans and Life Insurance. The whole economy grew on an index-linked framework encompassing, in addition to savings, also salaries and wages. This paper initially describes this structure in some detail, and how n particular for life insurance, it enabled the sale of unique plans linked to the Consumer Price Index.

A few years ago the Government decided to gradually decrease its intervention in the capital market so as to allow more freedom to Industry wishing to raise funds, with the objective of encouraging and stimulating economic growth. Part of this plan also entailed a reduction in rates of interest and the first steps were taken in moving away from the fully-linked environment. These steps have already had a major impact on Life Insurance, where a new with-profit framework had to be designed, taking into account wide-ranging considerations, which are set out in detail in the paper, together with a description of the solutions adopted.

Résumé

Implications de la Rupture avec l'Economie Indexée sur l'Assurance Vie en Israel

Il y a plus de 30 ans, à la suite d'un besoin urgent de se procurer des montants de capitaux très importants pour financer l'immigration et le développement industriel, le gouvernement israélien établit des obligations indexées en tant que véhicules de placement pour les fonds de retraites, les plans d'épargne bancaires et les assurances vie. L'ensemble de l'économie évolua dans un cadre indexé, englobant en plus de l'épargne, les salaires et les traitements. Cet article décrit tout d'abord cette structure en détail, et montre en particulier comment dans le cas de l'assurance vie, elle permit la vente de plans uniques liés à l'Index des Prix à la Consommation.

Il y a quelques années, le Gouvernement décida de diminuer progressivement son intervention sur le marché des capitaux pour permettre une plus grande liberté aux industries souhaitant se procurer des fonds, afin d'encourager et de stimuler la croissance économique. Une partie de ce projet entraînait également une réduction des taux d'intérêt et les premières mesures prises consistèrent à s'éloigner d'un environnement entièrement indexé. Ces mesures ont déjà eu un impact important sur l'Assurance vie où un nouveau cadre incluant la notion de profit a dû être conçu prenant en compte des considérations très vastes qui sont exposées en détail dans cet article, ainsi qu'une description des solutions adoptées.

1. INDEX LINKED ECONOMY - AS PRACTICED IN ISRAEL

It is essential initially to understand the framework and structure of the Israel index-linked economy and, therefore, we commence with a description of the Consumer Price Index, Inflation and the Cost of Living Allowance)

1.1 General

The objective of price indices is to measure the percentage changes occurring from time to time in the outlay necessary to purchase a fixed "basket" of goods and services. The basket contains goods and services of unchanging quality and quantity (or equivalent quantity), such that the changes in the index represent solely the changes in prices.

A system of weighting is used whereby the significance given to each item in the basket is equal to its proportion of the total expenses included in the index.

The changes in the level of prices of each item in the index are estimated by means of the change in the prices of a sample of various goods and services. The choice of the goods in the sample is made according to their importance as part of the expenses included in the Index and according to their ability to represent price trends of wide ranges of similar goods.

The fixing of the price of each item is carried out by means of a precise definition of the particular item and according to a set of rules designed to ensure that the Index will represent only changing prices and not changes in the quantity or quality. The prices include all taxes and duties including V.A.T.

A calculation is made of the changes of the price of each item in relation to its "base" price. The general Index results are a weighted average of the changes for all the items in the basket of goods and services.

The Index is updated every few years, at which time the basket of items and its various weightings are also updated.

1.2 Consumer Price Index (CPI)

The CPI relates to the goods and services consumed by all families that live in urban areas. The basket includes only consumer goods and services that are capable of measurement.

The breakdown of family expenses for consumption are arrived at by means of surveys. The changes in the level of prices of about 1300 such items are estimated. These prices are listed each month in a sample of 1700 shops and businesses in 42 cities and towns. Most of the prices are recorded by an official at the place of sale, whereas others, including various services (e.g., transport) are recorded in questionnaires which are sent by mail to those reporting.

The classification of each item is according to its category of consumption which defines to which Major Group of items it should be assigned. Table 1 sets out the Major Groups and their relative weighting.

Table 1: Make-up of Consumer Price Index by Major Grouping

Major Group	Weighting
Food (excluding fruits and vegs.)	165.1
Fruits and vegetables	64.2
Housing	164.6
House maintenance	93.3
Furniture and household items	71.8
Clothing and footware	72.0
Health	55.0
Education, culture, entertainment	120.1
Transport and communication	152.5
Sundries	41.4
Total	1000.0

The CPI and its component items are used primarily for the linkage of Bonds and Mortgages, for fixing Cost-of-Living (CoL) allowances to salaries and wages and for analyzing movement of prices in the economy (and also, as will be seen later, for adjusting life insurance premiums linked to the Index).

Table 2 sets out the percentage rates of inflation in Israel from 1970, as measured by the changes in the CPI.

Table 2: Increase in Consumer Price Index

Year	Percentage Increase (Dec.-Dec.)
1970	10.1
1971	13.4
1972	12.4
1973	26.4
1974	56.2
1975	23.5
1976	38.0
1977	42.5
1978	48.1
1979	111.4
1980	132.9
1981	101.5
1982	131.5
1983	190.7
1984	444.9
1985	185.2
1986	19.7
1987	16.1
1988	16.4
1989	20.7

1.3 Structure of Cost-of-Living Allowance (CoL Allowance)

CoL agreements are signed between the Histadrut (the Central Trade Union organization) and the body representing private industrial firms. The CPI and its components are utilized in fixing a formula for the CoL allowance applied to salaries and wages, and such formulae and the timing of the changes have varied over the years.

Differences between CoL Allowance and CPI

a) The Col Allowance is based on periodic averages of the CPI (annual, semi-annual, etc.), whereas the CPI is calculated and published monthly.

b) In the past, certain items of the CPI have, on occasion, been omitted in calculating the CoL Allowance, e.g., fruits and vegetables. At other times such "seasonable" items have been included on an annual average basis so as to smooth out the seasonal effect.

c) The housing component is taken into account in the CoL Allowance in a different manner to that in which appears in the CPI.

d) The CoL allowance has usually been fixed at 70-90% of the accumulated rise in the adjusted CPI during the period of measurement.

e) The CoL allowance is applied to salaries and wages only up to a certain maximum figure fixed for the period under consideration.

Taking into account the regulations used for the calculation of the CoL allowance, it follows that salaries and wages lose their purchasing power and do not keep pace in "real" terms as against the CPI. From time to time, wage agreements are reached between the Histadrut, Industry and the Government, which may or may not result in bridging the gap and at times may even exceed it, this of course, depending on political and economic considerations.

2. THE CONNECTION BETWEEN VARIOUS MEANS OF SAVINGS AND THE CPI

2.1 In the early 1950's there was an urgent need to raise large sums of capital to finance an enormous rate of immigration and industrial development. The government began to encourage purchase of Bonds through the various means of saving and, due to the concern at the time of the possible erosion of value, developed the Index-Linked Bond framework in order that its program would succeed. The main areas of saving are through Pension Funds, Banks and Insurance Companies.

2.2 Histadrut Pension Funds

Pension arrangements in Israel are largely based on funds established by the Histadrut, i.e., via the Trade Unions and not by means of a compulsory government pension framework. These arrangements encompass the majority of employees working in Industry.

Pensions - Retirement, Disability, Dependents

The plans include:

a) a retirement pension based on 2% of salary for each year of service (maximum 70%) at retirement age of 65 for males and 60 for females.

b) a disability pension (full or partial), based on the degree of disability and the accumulation of pension which would have accrued to date of retirement.

c) a pension to dependents following death, depending on the family status, to a maximum of 80% of salary.

The salary for the purpose of these calculations is arrived at by using an average of the monthly ratios of an individual's salary to the average salary in the economy multiplied by the average salary in the economy at the time of pension. (These items are affected by the CoL allowances as mentioned in 1.3 above.)

Contributions

The contributions are paid each month at a rate of 12% (employer) and 5.5% (employee) of the monthly salary. The employer's contribution is considered to absolve him of the need to pay severance pay.

Investment of Fund Assets

In accordance with the regulations of the Treasury, the Funds must invest the vast majority of their assets in government guaranteed bonds. A small portion of the assets may be used to provide loans to the Fund members.

Government Bonds carry interest at a rate of 6.2% p.a. where both capital and interest are linked to the CPI. These Bonds are specially earmarked for issue to the Pension Funds and are not available to the public. The

estimated total value of these Bonds at the end of 1988 was 17.6 billion N.I.S. (about $10.4 billion).

2.3 Provident Funds

General

These Funds represent a means of savings for individuals and employers. The sums saved, together with the accumulated profits, are at the disposal of the individual saver, subject to the legislative framework and tax considerations. Sums may be deposited monthly or periodically.

Types of Funds

Self-Employed Fund: A self-employed person may save sums of money, some of which are recognized for tax-deductibility, and where restrictions exist on his right to withdraw such funds before reaching retirement age (at least 15 years of fund membership), or on death or disability.

Severence Pay Fund: This is a vehicle for employers to fund their liability for severence pay to their employees (one month's salary for each year of service). Such payments are recognized for tax purposes.

Employee Superannuation Fund: It is common for both employer and employee to each set aside 5% of salary to accumulate in such a fund, where the accumulated sums are available to the employee at retirement age. Such sums are generally tax-deductible to the employer and, within certain limits, provide tax relief to the employee.

Investment of Fund Assets

In accordance with the regulations of the Treasury, the funds must be largely invested in Government Bonds (linked to CPI) which are available for purchase on the Tel Aviv Stock Exchange. The total value of such Bonds in these Funds at the end of 1988 was 19.7 billion N.I.S. (about $11.6 billion).

2.4 Insurance Companies

General

Life Insurance in Israel is characterized by complete linkage to the CPI. Since 1957 life insurance plans have been differentiated from other forms of insurance and investment in that they guarantee, in advance, the achievement of a future financial objective in real terms, and do not condition the payments to the policy-holder on the success or otherwise of the investment. In other words, the investment is not dependent on the expertise or investment policy of the Insurance Company.

Life insurance and penions linked to the CPI guarantee the full payment in "real" terms, of the sum insured or the pension as fixed at the time of purchasing the policy, with no reference to variations in the investment portfolio, but subject to the policy-holder paying a premium linked to the CPI.

Insurance companies in Israel are also permitted to market, in addition to regular Life and Individual Pension policies, various types of plans to employers and employees covering social benefits.

Investment of Life Insurance Funds

Insurance companies meet obligations linked to the CPI by means of an agreement between them and the Treasury, which provides coverage of linkage parellel to that provided by the policy conditions.

The agreement with the Treasury Department includes a guarantee of almost full linkage and interest. Furthermore, there also exists a commitment to continue to issue identical Government Bonds in the future to cover the growth of Life Insurance Reserves in respect of policies in force. The estimated value of such Government Bonds at the end of 1983 was 3.9 billion N.I.S. (about $2.3 billion)

Further details regarding the arrangements in respect of Insurance Companies are set out in Section 4.

3. RAMIFICATIONS OF LINKAGE ON THE CAPITAL MARKET STRUCTURE IN ISRAEL

3.1 Despite inflation and thanks to the CoL Allowance and wage agreements, salaries have depreciated only partly in real terms and sometimes even real growth has occurred.

3.2 When we look at savings held by the public, we see a picture similar to the changes in the average salary. Thanks to agreements with the Treasury Department relating to the issue to the public of Government Bonds linked to the CPI, in addition to those issued via special agreements to Pension Funds, Banks and Insurance Companies, savings did not lose their value, despite the extremely high inflation in the years 1979-85. The financial assets in the hands of the public at the end of 1988 amounted to 121.5 billion N.I.S. (approx. $71.7 billion), while 80% of this huge sum was invested in various types of Government Bonds. This phenomenon caused a sharp rise in the Internal Debt.

An Internal Debt of this size is evidence of a overly high intervention of the Government in the Capital Market, fixing artificial rates of interest, and resulting in pushing aside industrial firms wishing to raise funds.

3.3 Starting in 1986, the Government reached a policy decision to gradually withdraw from the Capital Market by way of amendments to the regulations relating to the make-up of the investments of Provident Funds, and in 1988 the rates of interest granted on Government Bonds earmarked to cover new Life Insurance policies was reduced. This trend in the withdrawal of the Government from the Capital Market has continued in order to reduce the Internal Debt and to allow the Market to operate in a more balanced framework with the objective of encouraging and stimulating economic growth.

4. DESCRIPTION OF INVESTMENT AGREEMENT WITH THE TREASURY DEPARTMENT - LIFE INSURANCE

4.1 In 1957 a new era in Life Insurance was introduced in Israel (and indeed perhaps, in the world), when the first investment agreement was signed between the Treasury Department (on behalf of the Government of Israel) and the Association of Life Insurance Companies in Israel. This agreement committed the Treasury to issue Government Bonds, linked to the CPI with a guaranteed rate of interest also linked to the CPI, as backing for life insurance policies similarly linked to the CPI.

4.2 By means of collecting premiums which would also be linked to the CPI, the effect was achieved of neutralizing the effects of inflation, and permitting the actuarial calculations to be based on the guaranteed "real" rate of interest (with an allowance for profit and expenses).

4.3 The major points involved in this arrangement, as initiated and also amended over the years were:

a) The Government guaranteed to issue such Bonds initially for various series of policies in respect of premiums on such policies for as along as 40 years into the future, a provision expanded in later agreements to premiums on each series of policies until the final maturity or death of each policy. Hence such policies could be sold guaranteed to be linked to the CPI.

b) Such Bonds were issued with varying terms but, on redemption, the proceeds could be reinvested with the same conditions. In the event of a reducing fund and early redemption being required this was guaranteed to be carried out at fully linked par value, with no capital loss (or profit).

c) The systems of CPI linkage underwent changes over the years. Due to administration concerns on premium collection, for a long period the insurance Index was frozen for half-yearly periods. Subsequently, due to rampant inflation, this was changed to the common monthly CPI basis.

d) Due to inconsistencies between the CPI framework operated for premium collection and claims payment, as compared to that applied to the earmarked Government Bonds, there existed for many years a built-in loss to the companies of two indices. When the CPI was running at a low rate, this was absorbed by the Companies. However, rampant inflation in the late 70's and 80's threatened to wipe out Life Fund profits and so two steps were taken:

   i) A part of life funds was required to be invested in solid investments, bank deposits and loans, and a further part was optionally allowed to be invested in Government Bonds on the Stock Exchange. Both of these were carrying high yields in real terms at the time and could provide a substantial offset to the indices losses.
   ii) A new series of policies was initiated where, at time of premium collection, the premium was increased by the two-index loss.

e) In general, the interest on these Bonds was subject to tax deduction at source, at rates which varied from time to time, but this tax was in effect, an advance payment on account of subsequent tax on profits, and was therefore generally offset (although there could often be a loss due to loss of interest and inflation on such advance payments).

4.4 The various series of Bonds issued are shown in Table 3 below and it should be borne in mind, as mentioned previously, that these Bonds are still issued in respect of premiums continuing to be received on the parallel series of policies, if the relevant fund for such policies is increasing. The details in the table relate to the current situation even as modified retroactively to the older funds.

4.5 Following lengthy negotiations in March 1989, a new fund series was inaugurated (Series Chet in Table 3), designed as backing for a new life insurance framework, participating in profits, (which is described in Section 6), where the percentage of the funds invested in government guaranteed bonds was reduced to 50%.

4.6 At present it seems possible that, in keeping with declared government policy, a further reduction in guaranteed linkage and/or rate of interest is on the horizon: the only uncertainty at present is whether this will arrive in January 1991 or be delayed for another year or two?

Table 3: Details of Government Guaranteed Bonds Earmarked for Life Insurance Funds

Dates of Series of Policies Issued	Name of Fund Series	Method of Bond Linkage	Method of Premium Linkage	Rate of CPI-Linked Interest	Term of Bonds	% of Fund in Govern't Bonds#	% Tax Deducted at Source	Comment
10/1957- 1/1975	ALEPH	Half-yearly	Half-yearly	6.2%	10 yrs	100%	25%	-
2/1975 - 11/1976	BET	Monthly	Monthly	6.2%	25 yrs	85%	25%	-
12/1976- 12/1977	GIMMEL	Monthly	Monthly	5.2%	25 yrs	85%	25%	-
1/1978 - 3/1979	DALET	Monthly	Monthly	5.2%	25 yrs	85%	35%	-
4/1979 - 12/1982	HAY	Monthly	Monthly	5.2%	17 yrs	85%	35%	-
1/1983 - 3/1988* 1/1983 - 12/1989**	VAV	Monthly	Monthly + 2 indices	5.2%	12 yrs	85%	35%	*Individual policies. **"Business" pension policies.
4/1988 - * 1/1990 - **	ZAYIN	Monthly	Monthly + 2 indices	4.0%	12 yrs	85%	35%	*Individual policies. **"Business" pension policies.
3/1989 -	CHET	Monthly	Monthly + 2 indices	5.2%	12 yrs	50%	35%	With-profit policies - other 50% "free", see Section 6.

In the series Bet through Zayin, the remaining 15% must be invested in solid investments, bank deposits and loans. Furthermore, at various times part of the amount, 85%, normally invested in the earmarked Government Bonds was permitted to be invested in Government Bonds available on the Stock Exchange, so as to take advantage of the higher yields available on those bonds at those times.

5. CONSIDERATIONS IN THE DEVELOPMENT OF A NEW LIFE INSURANCE FRAMEWORK

5.1 It is clear, therefore, that the Life Insurance Industry faced with the following situation:

a) In general terms, the governmental policy decision to move towards a freer capital market and to push the economy away from a completely linked environment.

b) In relation to the Life Insurance Industry itself, to move away from the "artificial" environment in which it had been operating for over 30 years, with nearly complete reliance on government-linked bonds for investment of Life funds, which allowed for the commensurate sale of fully linked Life products.

c) A substantial fall in the rates of inflation from the very high annual inflation rate of nearly 500% in 1985 to a still high but relatively (for Israel) "low" figure of less than 20% p.a. in recent years.

d) A fairly stable exchange rate policy.

5.2 It might be thought that a natural outcome of the above situation would have been to develop a new life insurance environment, using as a basic model, the structure existing in the U.S.A. or European markets. However, this approach was not adopted after the following considerations were examined at length:

a) Israel, although a small country, has a sophisticated sales-motivated insurance market, with a relatively large number of companies, all competing intensively for their share of the market. However, any precipitous and too loosely regulated move into a hitherto unknown with-profits product era could result in disasterous competitive pressures.

b) Companies had gone through several difficult years with losses on non-life business, having been covered by the life insurance profits. With constant pressure on life profits due to reducing investment margins and competitive pressure pushing commissions upwards, an approach was desired which would not result in further reducing profit margins.

c) Payment of fixed premiums in local Israeli currency was universally rejected due to major concern over the need to ensure that "tomorrow's" expenses would be covered without having to guess future rates of inflation. This feeling was based on the results of previous historical attempts to fix level unlinked premiums, all of which failed miserably, when after the passage of time, the premium became worthless. It is a sobering thought that even at a "low" inflation rate of 15% p.a. a premium fixed today will only be worth one-quarter of its current value in 10 years' time and about 3% in 25 years. In this connection it is worth recalling the annual rates of inflation which have still prevailed following the introduction of the major economic plan in 1985 (see Table 2).

d) For over 30 years the Israeli public (and perhaps in this case even more important, the insurance brokers and agents) had become used to insurance plans fully linked to the CPI, of which a fundamental element was payment of a premium, in most cases monthly, which changed each month in accordance with the changes in the CPI.

5.3 In the light of the above considerations, the following fundamental decisions were made:

a) For at least an initial period, until such time as with-profits products begin to become more acceptable to the public and seen to be marketable to agents and brokers, to design products conforming as close as possible in form to those familiar products then being marketed.

b) To collect premiums linked to the CPI so as to achieve two objectives:

i) To attempt to ensure that cover for future expenses would not be imperilled as the expense loading in those premiums would at least also change in accordance with the CPI.

ii) To make it much more likely that the policyholder receive, in the future, benefits which would not suffer from the ravages of inflation (see 5.3 (c) below).

c) In return for the policyholder's trust in the companies, as displayed by his willingness to pay a CPI-linked premium, to find a way to guarantee that at least we could perform our primary insurance function and provide CPI-linked coverage in the event of death and, if possible, also disability, and a CPI-linked sum on maturity of the policy.

d) To design a with-profit framework that initially, at least, only relates to investment profits or losses, i.e., the sole area which had received the attention of the government, and resulted in the need for the changes under consideration. Hence, no other areas of profits or losses would be amended and in accord with new government policy the investment risk would now be borne by the policyholder, subject to the degree of investment expertise of the insurance company in which he chose to invest his premium.

e) To fix a rigid formula for distribution of investment profits, after allowing for investment administrative expenses, so as to ensure that the investment yield to be credited to the policyholder would be determined by an identical mathematical structure in each company; thus any difference from company to company would be due only to variations in investment expertise.

6. THE INVESTMENT "BASKET" AND YIELD CALCULATIONS

6.1 The above decisions would most likely have been taken in any event. An added factor which also indicated the willingness of the Treasury Department for insurance companies to venture gingerly into the new untried waters, was the investment structure which they designed (after intensive discussions with the Insurance Industry) to form the backing for the new type of policies. It was primarily based on a continuation of government-linked bonds and a guaranteed rate of interest of 5.2% for 50% of the fund, together with so-called "free" investments for the other 50%. The actual "Basket" was as follows:

	Max.	Min.
1. "Guaranteed"		
Earmarked Government Bonds 100% linked to CPI carrying 5.2% interest linked to CPI. (If less than 50%, remainder to be invested in Government Bonds available on the Stock Market.)	50%	25%
2. "Free"		
a) Government bonds available on the stock market.	50%	15%
b) Commercial loans and bank deposits	15%	0%
c) Mortgages	8%	0%
[(b) + (c) together not to exceed 20%]		
d) Commercial debentures	8%	0%
e) Property	8%	0%
f) Equities	8%	0%
[(e) + (f) together not to exceed 12%]		

6.2 It should be emphasized that this framework of 50% guaranteed investment and 50% "free", was fixed to apply to all policies sold for the duration of premium payments on such policies so that the purchaser would know that the insurance companies would be guaranteed to receive full linkage to the CPI and a high rate of interest on at least 50% of their money. However, the make-up of the 50% "free" investments could be changed with the passage of time as the companies acquire expertise in areas in which experience had only been limited previously.

6.3 The method fixed for calculating the monthly yield on the total fund (including both the guaranteed CPI-linked half and the "free" half) was as follows:

A = the value of the fund investment at the end of the month.

B = amounts paid out of the fund during the month.

C = the value of the fund investments at the end of the previous month.

D = amounts invested in the fund during the month assumed to be received at due date at the beginning of the month).

E = Investment management expenses of 0.75% of value of fund at end of month. ($\div 12$).

$$\text{Then } Rm = \frac{A + B - C - D - E}{C + D - B/2}$$

i.e. gross investment yield (after deducting expenses)

$$Ym = \frac{(1 + Rm)}{Im/I(m-1)}$$

i.e. Rm after neutralizing growth in CPI

Where Im = CPI known at end of month m.

Then BEm, the net monthly yield credited to the policyholder is derived as:

Where $Ym < ((1.03)^{1/12} - 1)$ then $BEm = Ym$
and when $Ym \geq ((1.03)^{1/12} - 1)$ then
$BEm = ((1.03)^{1/12} - 1) + 0.85 \times (Ym - ((1.03)^{1/12} - 1))$

i.e. The policyholder receives 100% of the yield obtained (after expenses) up to CPI growth plus 3% p.a., whereas the excess over this is split 85% to policyholder and 15% to the insurance company, the intention being to provide an incentive to the insurance company to achieve maximum yield commensurate with security.

6.4 The method and the techniques used for converting this yield into a bonus for the various types of insurance plans is really beyond the scope of this paper, which set out to concentrate primarily on the investment considerations. Suffice it to state, bearing in mind the objective indicated in 5.3 (c), that this could only be achieved, in the event of an accumulated shortfall, in relation to the technical rate of interest at which the policy was designed, by collecting an extra premium to compensate, which could be reduced in the event of subsequent bonuses developing. It is instructive nevertheless to look at the operation of this technique in a simplified format. Thus, some simulations based on this approach are demonstrated in the Appendix as operating in a pure Savings framework.

6.5 In a paper presently in preparation we will describe in detail all the actuarial techniques utilized in designing the full Life Insurance framework, the problems encountered and solutions developed.

7. Acknowledgements: The development of the approach described in sections 5 and 6 was an outgrowth of marathon discussions which took place between representatives of the Treasury Department and the Life Insurance Industry. We wish to acknowledge the contribution by all our colleagues (who are too numerous to mention individually) to the solutions which evolved.

REFERENCE

Tables of CPI and data were taken from the Israeli Statistical Year Book, 1989.

APPENDIX

DESCRIPTION

Plan: Capital Redemption Policy (Savings). Term n = 30 years.
"Real" (in excess of CPI) Rate of interest: 3.5%

Symbols: As set out in Section 6.3 and then:-

$$FBEm = \frac{(1 + BEm)}{(1.035)^{1/12}} - 1$$

V(t) = Reserve at end of year t

NP = Net Premium

Bonus B(t) = (V(t) + NP) x FBEm

Accumulated Bonus TB(t) = TB(t -1) x (1 + BEm) + B(t)

Extra Premium (from end of year t) - if TB(t) is negative $= - \frac{TB(t)}{\ddot{a}_{\overline{n-t}|}}$

Inflation: All figures are shown in "real" terms, i.e., after neutralizing the effects of inflation.

Note: For simplicity, all the simulations were carried out on the basis of an annual premium policy and as if Bonuses are calculated only at the end of each year (with an annual yield calculation). This has been indicated in the Examples by adding (t) to the terms, Ym, BEm and FBEm).

Results and Comments

1. A net rate of interest of 3.5% to the policyholder keeps the policy in a neutral state, i.e., no Bonus or "Mallus" (and hence, no need for an extra premium). This occurs if a "real" rate of interest of 3.54% is achieved consistently on the 50% "free" investments.

2. A constant yield on the "free" investments of 4% will produce at maturity a bonus of 33 per mille of the sum insured, in addition to the saving of 1000.

3. A constant yield on the "free" investments of 2.80% will produce an accumulating Mallus which is amortized by small additional premiums. However, these extra premiums do grow substantially close to maturity (as shown in Example 1 and Graph 1), but this system ensures that the policyholder will receive, on maturity, the full sum saved in "real" terms.

4. In reality, there will be upward and downward movements of interest rates resulting in, e.g., periods of bonuses which would first be utilized to cover prior or subsequent malluses. Only if an accumulated mallus develops would an additional premium be needed and it would only reach a high relative value if such a situation developed towards the maturity of the policy (when the reserve is high). One scenario is demonstrated in Example 2 and in Graphs 2 and 3, which shows the effect of an initial yield of 3.80% on the "free" 50%, dropping to 3.0% and subsequently returning to the initial level.

   The operation of the extra premium technique in the period of mallus keeps the plan on target for achieving the fully linked savings objective.

5. It is apparent that the "Government" 50% investments at a "real" guaranteed yield of 5.2% cushions considerably variations which can occur on the "free" investments.

6. In simple terms, a major objective would be to attempt to accumulate bonuses in the early and middle years so as to be prepared for a down-turn in fortunes if such should occur in later years.

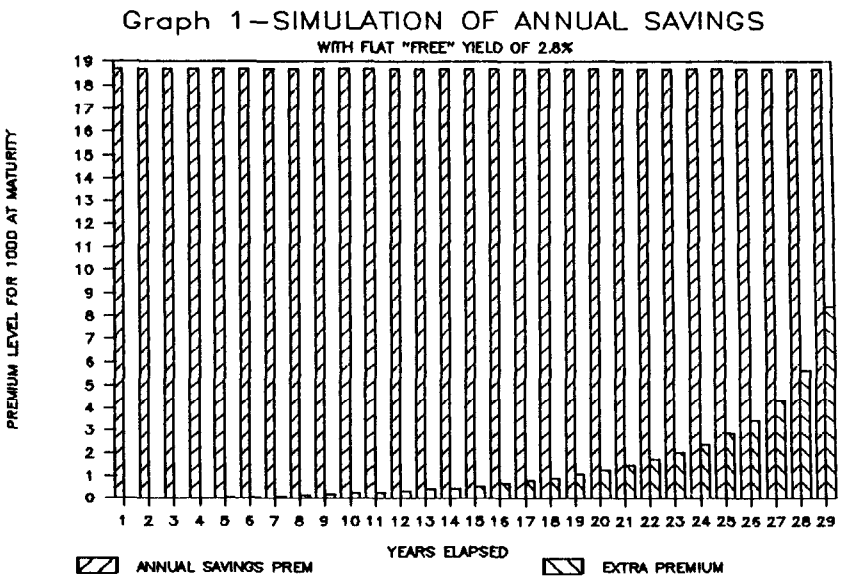
7. The extension of this technique to Life and Annuity policies will be described in detail in the follow-up paper currently under preparation.

Example 1

Capital Redemption Policy

Sum Ass'd(Savings) 1000 Int Rate 3.50%
Term 30 Net Prem 18.72

year t	"G'teed" Invest Yield (50%) %	"Free" Invest Yield (50%) %	Average Gross Yield (100%) %	Ym(t) Average Real Net Yield %	BEm(t) Net Yield to P'holder %	FBEm(t) Yield for Bonus %	Regular Annual Premium	V(t-1) + Net Premium	Bonus B(t) at end of year	Acc'd Bonus TB(t)	Extra Premium from end year t	year t
1	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	18.72	-0.1	-0.1	0.00	1
2	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	38.09	-0.1	-0.2	0.01	2
3	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	58.14	-0.2	-0.3	0.02	3
4	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	78.89	-0.2	-0.6	0.03	4
5	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	100.37	-0.3	-0.9	0.05	5
6	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	122.59	-0.4	-1.2	0.07	6
7	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	145.60	-0.4	-1.6	0.10	7
8	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	169.41	-0.5	-2.1	0.13	8
9	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	194.06	-0.6	-2.6	0.17	9
10	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	219.57	-0.7	-3.2	0.21	10
11	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	245.97	-0.7	-3.8	0.27	11
12	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	273.29	-0.8	-4.5	0.33	12
13	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	301.58	-0.9	-5.2	0.39	13
14	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	330.85	-1.0	-5.9	0.47	14
15	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	361.14	-1.1	-6.7	0.56	15
16	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	392.50	-1.2	-7.5	0.67	16
17	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	424.95	-1.3	-8.4	0.79	17
18	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	458.54	-1.4	-9.2	0.92	18
19	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	493.31	-1.5	-10.1	1.08	19
20	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	529.29	-1.6	-10.9	1.26	20
21	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	566.53	-1.7	-11.6	1.48	21
22	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	605.08	-1.8	-12.3	1.73	22
23	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	644.97	-2.0	-12.9	2.03	23
24	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	686.26	-2.1	-13.2	2.40	24
25	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	729.00	-2.2	-13.4	2.87	25
26	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	773.23	-2.3	-13.2	3.47	26
27	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	819.01	-2.5	-12.5	4.32	27
28	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	866.39	-2.6	-11.1	5.64	28
29	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	915.43	-2.8	-8.4	8.39	29
30	5.20	2.80	4.00	3.22	3.19	-0.30	18.72	966.18	-2.9	-2.9	2.92	30


Graph 1—SIMULATION OF ANNUAL SAVINGS
WITH FLAT "FREE" YIELD OF 2.8%
PREMIUM LEVEL FOR 1000 AT MATURITY
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
YEARS ELAPSED
ANNUAL SAVINGS PREM
EXTRA PREMIUM

Example 2

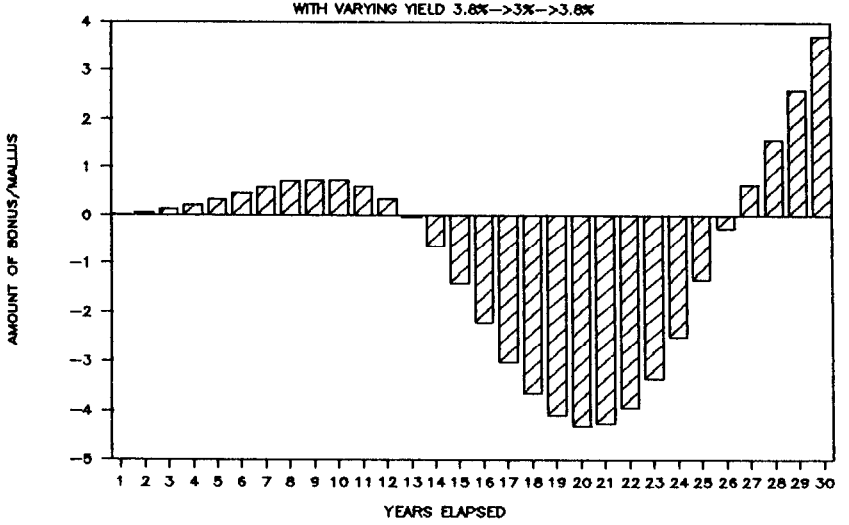
Capital Redemption Policy

Sum Ass'd(Savings) 1000 Int Rate 3.50%
Term 30 Net Prem 18.72

year t	"G'teed" Invest Yield (50%) %	"Free" Invest Yield (50%) %	Average Gross Yield (100%) %	Ym(t) Average Real Net Yield %	BEm(t) Net Yield to P'holder %	FBEm(t) Yield for Bonus %	Regular Annual Premium	V(t-1) + Net Premium	Bonus B(t) at end of year	Acc'd Bonus TB(t)	Extra Premium from end year t	year t
1	5.20	3.80	4.50	3.72	3.61	0.11	18.72	18.72	0.0	0.0	0.00	1
2	5.20	3.80	4.50	3.72	3.61	0.11	18.72	38.09	0.0	0.1	0.00	2
3	5.20	3.80	4.50	3.72	3.61	0.11	18.72	58.14	0.1	0.1	0.00	3
4	5.20	3.80	4.50	3.72	3.61	0.11	18.72	78.89	0.1	0.2	0.00	4
5	5.20	3.80	4.50	3.72	3.61	0.11	18.72	100.37	0.1	0.3	0.00	5
6	5.20	3.80	4.50	3.72	3.61	0.11	18.72	122.59	0.1	0.5	0.00	6
7	5.20	3.70	4.45	3.67	3.57	0.06	18.72	145.60	0.1	0.6	0.00	7
8	5.20	3.70	4.45	3.67	3.57	0.06	18.72	169.41	0.1	0.7	0.00	8
9	5.20	3.55	4.38	3.59	3.50	0.00	18.72	194.06	0.0	0.7	0.00	9
10	5.20	3.50	4.35	3.57	3.48	-0.02	18.72	219.57	0.0	0.7	0.00	10
11	5.20	3.40	4.30	3.52	3.44	-0.06	18.72	245.97	-0.1	0.6	0.00	11
12	5.20	3.30	4.25	3.47	3.40	-0.10	18.72	273.29	-0.3	0.4	0.00	12
13	5.20	3.20	4.20	3.42	3.36	-0.14	18.72	301.58	-0.4	-0.1	0.00	13
14	5.20	3.10	4.15	3.37	3.31	-0.18	18.72	330.85	-0.6	-0.6	0.05	14
15	5.20	3.00	4.10	3.32	3.27	-0.22	18.72	361.14	-0.8	-1.4	0.12	15
16	5.20	3.00	4.10	3.32	3.27	-0.22	18.72	392.50	-0.9	-2.2	0.19	16
17	5.20	3.00	4.10	3.32	3.27	-0.22	18.72	424.95	-0.9	-3.0	0.28	17
18	5.20	3.10	4.15	3.37	3.31	-0.18	18.72	458.54	-0.8	-3.6	0.36	18
19	5.20	3.20	4.20	3.42	3.36	-0.14	18.72	493.31	-0.7	-4.1	0.44	19
20	5.20	3.30	4.25	3.47	3.40	-0.10	18.72	529.29	-0.5	-4.3	0.50	20
21	5.20	3.40	4.30	3.52	3.44	-0.06	18.72	566.53	-0.3	-4.2	0.54	21
22	5.20	3.50	4.35	3.57	3.48	-0.02	18.72	605.08	-0.1	-3.9	0.55	22
23	5.20	3.60	4.40	3.62	3.52	0.02	18.72	644.97	0.2	-3.4	0.53	23
24	5.20	3.70	4.45	3.67	3.57	0.06	18.72	686.26	0.4	-2.5	0.45	24
25	5.20	3.80	4.50	3.72	3.61	0.11	18.72	729.00	0.8	-1.3	0.29	25
26	5.20	3.80	4.50	3.72	3.61	0.11	18.72	773.23	0.8	-0.3	0.07	26
27	5.20	3.80	4.50	3.72	3.61	0.11	18.72	819.01	0.9	0.6	0.00	27
28	5.20	3.80	4.50	3.72	3.61	0.11	18.72	866.39	0.9	1.6	0.00	28
29	5.20	3.80	4.50	3.72	3.61	0.11	18.72	915.43	1.0	2.6	0.00	29
30	5.20	3.80	4.50	3.72	3.61	0.11	18.72	966.18	1.0	3.7	0.00	30

Graph 2—SIMULATION OF BONUS/MALLUS

WITH VARYING YIELD 3.8%—>3%—>3.8%



Graph 3—SIMULATION OF EXTRA PREMIUM

WITH VARYING YIELD 3.8%—>3%—>3.8%