



# Bank of Israel

## Monetary Department

### Monetary Studies

*A Guaranteed-Return Contract  
For Pension funds' Investment  
In the Capital Market*

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IN THE CAPITAL MARKET**

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The views expressed in this paper are those of the authors only, and do not necessarily represent those of the Bank of Israel or The Hebrew University.

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## **A guaranteed-return contract for pension funds' investments in the capital market**

### **Summary**

Current arrangements for pensions in Israel suffer from numerous problems and shortcomings. This paper deals with one of the more serious among them, the channeling of pension funds into nontradable earmarked bonds at guaranteed and subsidized rates of interest. This arrangement enables the pension funds to bypass the capital market, with all the negative effects that this situation causes.

Incorporating the pension funds into the capital market in Israel is very important for the development and improvement of the primary and secondary capital markets. The problem is that pension funds' managers and members are apprehensive about investing in tradable capital markets, particularly in equity, due to their volatility. High volatility means that the value can drop sharply, and may cause the funds difficulties in meeting their commitments to their members.

It will therefore be hard to integrate the funds into the capital market without developing instruments that will deal with the concerns of the pension funds arising from this uncertainty. Such market-oriented instruments, provided by the private sector, do exist in other countries, but the authors are of the opinion that without at least temporary involvement of the government to encourage the development of the market, it will prove difficult to create such instruments in Israel and to convince the pension funds to invest in the capital market. This paper will show that the problem can be solved by changing the use made of the current budgetary support allocated for pensions.

Converting the current arrangement into a direct subsidy of the funds or their members, as has been proposed, will not solve the problem of uncertainty. This paper focuses on the problem of the funds' uncertainty which arises from the capital market's volatility. The proposal herein consists of two main components: the first is creating pension funds for new members which will not be entitled to purchase earmarked bonds at guaranteed interest; the second is a limited-quantity tender of a composite contract which will enable funds to hedge the risk inherent in investing in shares (the purchase of put options by the funds) against their waiving part of the market return (by writing call options). The body dealing with the tender could be a public corporation (such as Inbal Insurance Co.) whose equity capital would be increased by transferring sums of money which would otherwise be directed to pension subsidies. The authors expect that in the not-too-distant future the private sector will join these activities, as occurred in the development in the foreign-exchange options market when the Bank of Israel started its activity in that area.

A simulation for the years 1969–99 reveals that the return received by those pension funds which invested in the stock market in combination with the proposed contract exceeded that currently being earned on earmarked bonds, and even the insurer's

account accrued a positive balance in that period by applying the contract. In other words, the situation of the pension funds and their members would have been better than it is currently. Nevertheless, there could be periods when share prices fall constantly, causing erosion of the capital equity of the public corporation selling the proposed contract, and it is suggested that to minimize the probability of such an event, the extent of the contracts offered should alter in accordance with the degree of risk relative to the company's equity.

## 1. INTRODUCTION

Pension funds in Israel currently channel most of the savings they attract into the purchase of nontradable government bonds with guaranteed interest. This gives rise to a situation which is problematic for many reasons, the main ones being:

- (a) It has a strong adverse effect of the functioning of the domestic capital market: as a result of the current pension arrangements, there is a dearth of institutional investors with long-term investment horizons who bring stability and depth to the primary and secondary markets. In the absence of a developed capital market with pension funds in a central position, most of the capital raised by domestic companies continues to be raised abroad (in 1999 about 80 percent of issues by Israeli companies were carried out abroad).
- (b) It adversely affects competition in the pension market because of the high proportion of investments in earmarked bonds.
- (c) It harms the tradable government bond market, particularly when the budget deficit is on a declining path and its financing requirements are falling, so that a significant share of finance is still via nontradable bonds. The contraction of the tradable bond market makes it difficult to create a benchmark in the market, thereby also impairing the development of the corporate bond market, which could serve as an alternative to finance provided by the over-concentrated commercial banking system.
- (d) It creates an artificial benchmark for long-term real interest—via the sale of bonds at guaranteed interest—which is totally unrelated to the return on capital.
- (e) It has a harmful effect on the returns which the funds could obtain because their return is relatively low compared with that in the market, so that pensions paid are lower and/or current contributions to pension funds are higher.
- (f) It hampers efficient diversification by preventing the investment in securities abroad of part of the funds accrued.
  - Tax reform (such as that proposed by the Ben-Bassat Committee) which gives priority to pension funds makes reform of their investments in the market even more necessary. Furthermore, the expected move of public-sector employees from unfunded to funded pensions will lead to an increase in pensions' share in the public's assets portfolio, and the pension funds' absence from the capital market will be felt even more strongly.
  - The domestic pension funds' avoidance of investing in Israeli companies is even more striking in the light of the opening of Israel's economy to investors abroad, including foreign pension funds. Thus the incongruous situation exists in which pensioners abroad benefit from the high returns on investments in Israeli high-tech companies while in practice these investments are unavailable to Israeli pensioners.

One major reason for pension funds' anxiety about investing in the capital market is their members' opposition to being exposed to the volatility of investments in market-type instruments, and particularly that of share prices. In this context the experience of the provident funds in the 1990s is relevant; at that time they were exposed to the risks of investing in capital-market instruments, in contrast to the security they enjoyed previously when their money enjoyed the privilege of earmarked bonds at guaranteed interest. That

experience (without going into the reasons for it) increased the aversion of those with savings in the pension funds to the volatility of investment in the capital market.

Pension arrangements in Israel affect both the capital and the labor markets, and may require comprehensive reform. This paper does not attempt to deal with all these aspects, but focuses on the effects of the current pension arrangement on the capital market.

The authors assess that despite the urgency of channeling pension savings into the capital market, it will prove extremely difficult to achieve this without a catalyst, albeit temporary, to handle the pension funds' and their members' aversion (real and imaginary) to the volatility in the capital market. This discussion suggests that the aversion can be cured, not by means of earmarked bonds bearing a constant real return, but by a combination of investment in the capital market and purchase of instruments which hedge against capital market volatility. Specifically, the authors propose that:

- (a) From a date to be determined there should be new pension funds which will not be entitled to a guaranteed return via earmarked bonds, and enrollment of new members to the existing funds will cease;
- (b) Concurrently, contracts will be issued (regarding the question "by whom," see below), enabling pension funds wishing to do so to invest in shares while hedging against the risks inherent in such investments.

Hedging savings will be accomplished by insuring a given real return, against which the funds will waive part of the rise in share prices in a predetermined period of time.

Section 2 explains the contract and contains a proposal for reducing uncertainty. Section 3 describes the proposed institutional arrangement—the entity which offers the contract and those entitled to purchase it, and the fourth section discusses methods of implementing the contract. Section 5 presents the theoretical framework, using diagrams to illustrate the treatment of the risks. The sixth section considers the implications of implementing the contract on the capital market and on the budget; Section 7 describes the MIT proposal for pension reform, which in certain situations is similar to the proposal in this paper. The eighth and final section shows the results of the simulation performed with data from the domestic capital market for the years 1969 to 1999.

## 2. THE ESSENCE OF THE CONTRACT

The object of the contract is to enable pension funds to invest in a stock-price index, at the same time hedging against the level of risk inherent in such activity. The funds will receive a guaranteed (minimum) return *plus* a certain share of the rise in the index. The combination of investment in the stock price index and the contract to be described below will give the pension funds the opportunity to increase the expected return, based on the capital market, while the investment is hedged by a guaranteed minimum rate of return. For example, in exchange for a guaranteed real return of three percent per annum for ten years the pension funds would waive 44 percent of the cumulative rise in the stock price index in that period (these numbers are based on the simulation which is presented in Section 8). In other words, at the end of the ten-year period the cumulative annual rise of the selected stock price index is calculated, and when this cumulative rate is lower than three percent per annum, the insurer transfers the difference to the pension funds; when the rate is higher

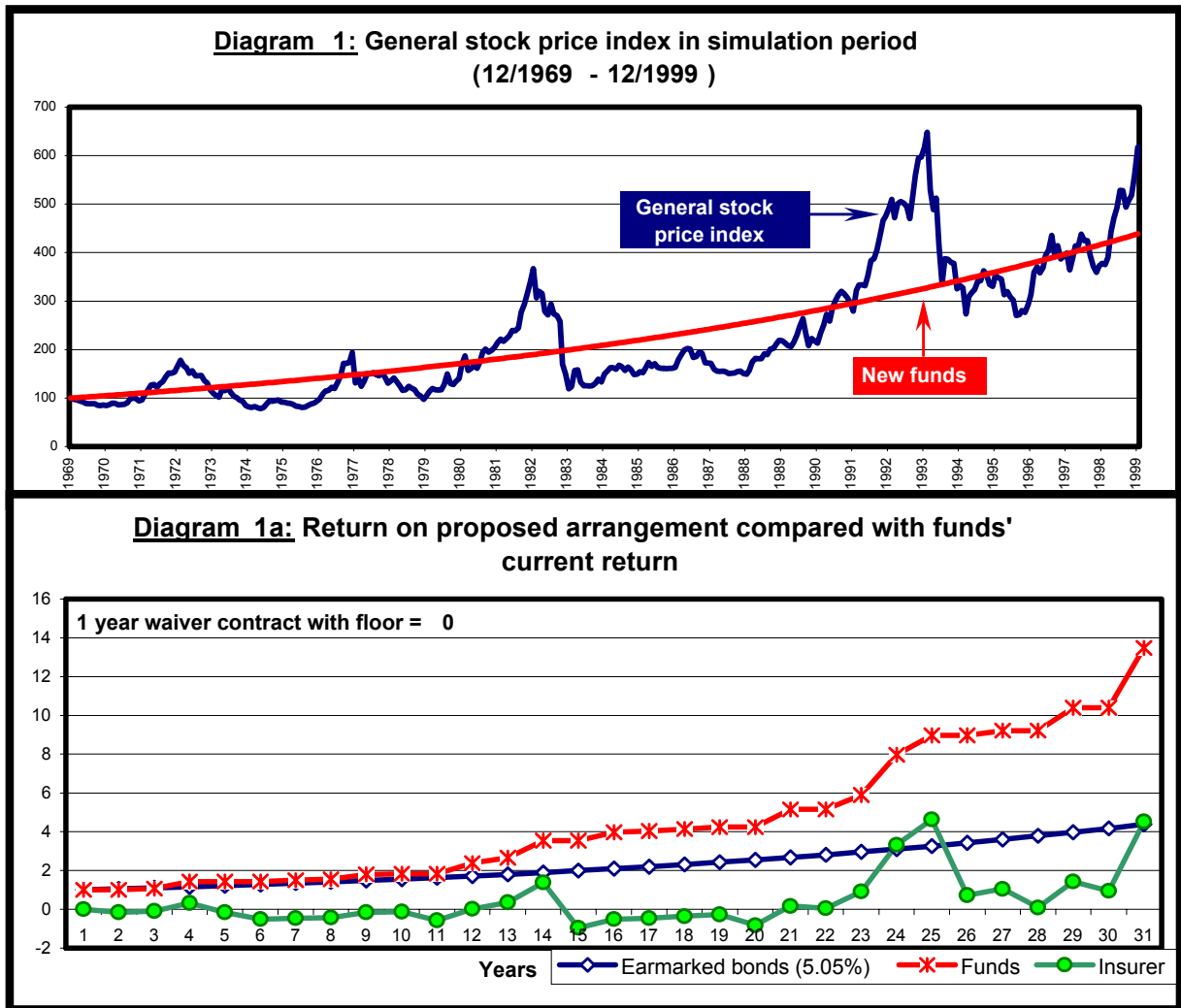
than three percent, the funds transfer to the insurer 44 percent of the rise in the index above 3 percent, and keep the remaining 56 percent of the increase. Stated simply, when the total return on the stock price index is lower than the guaranteed minimum return, the insurer will transfer the difference to the funds; otherwise the funds will transfer to the insurer a certain share—henceforth the “rate of waiver”—of the surplus return (that in excess of the guaranteed return) as defined in the contract (see Figures in Section 5). (In the simulation performed for the years 1969–99 shown in Section 8, the annual real return earned by the pension fund was 6.4 percent, higher than the current guaranteed rate of 5.05 percent.)

In another example, where the contract was for one year, the result was that with a minimum real return of 0 percent, i.e., a guarantee that there will be no erosion of the return in real terms, using the Black-Scholes (B&S) model, the rate of waiver was 53 percent. This means that if there is a positive real return, the fund transfers to the insurer 53 percent of the rate of return on the stock price index, and if the return is less than that guaranteed, i.e., if it is negative in real terms, the insurer transfers the difference to the fund, bringing the return up to the minimum level. (In the simulation, the annual return received by the funds was about 9 percent.)

The essence of the contract is illustrated in Figure 1(a), which shows the funds’ cumulative return with a waiver contract of one year, and a guaranteed zero return. The figure shows that the cumulative return is far higher than that received on the new earmarked bonds (9 percent and 5 percent respectively). In effect the contract allows the funds to benefit from the fruits of the capital market in good years, and guarantees a minimum return, guaranteed by the insurer, in less good years.

The contract can also be of a “floor–ceiling” type, in which the insurer guarantees a minimum return, as in the previous version, but the fund undertakes to transfer the annual return in excess of a particular rate. For example, for a guaranteed annual return of 2 percent, the fund undertakes to transfer all profits in excess of 10.9 percent (see Table 1). The difference between the two types of contract is in the way the risk is divided between the insurer and the funds. It is not clear whether one of the alternatives is intrinsically preferable, and at this stage both will be described.





It may be argued that since funds accepting the proposed contract will invest in the market portfolio (or more precisely in a portfolio which is identical to the one defined in the contract), no contribution is made to the development of the domestic capital market. The authors reject this claim because investing in the stock market will enable the funds to develop strategies in the area of controlled risk-taking (which will meet supervisory conditions laid down by the supervisors). In this case it will be worthwhile to change the composition of the portfolio to a certain extent while observing appropriate risk management. This will stimulate the process of examining investment opportunities, contributing to the further enhancement of the capital market.

It might indeed be preferable to end the issue of earmarked bonds gradually and allow the pension funds to enter the capital market without the proposed instrument. The authors have no economic argument against this option, but believe that currently it would not receive sufficient political support, and they therefore propose an instrument which in the interim will deal with the risks incurred as a result of investing in the capital market.

In the past a proposal was put forward to reform pension fund investment, the main idea of which was to discontinue the issue of earmarked bonds and to grant the pension funds a direct subsidy. Earmarked bonds have two important characteristics: one is a guaranteed return, and the other is lowering the risk incurred in investments. This second aspect is

specially important regarding long-term investments of defined-contribution pension systems. Ending earmarked bonds and transferring a direct subsidy does solve the problem of the return, but hardly relates to the question of the risk and the guaranteed return which is vital for actuarial balance, so that from this aspect the solution proposed herein is preferable.

The authors are aware of the possibility that the offer of a contract may *per se* encourage funds to follow a dangerous path by purchasing the hedging instrument described above, on the one hand, and undertaking uncontrolled investments in stocks and bonds with higher risks than that of the stock price index, on the other. This can be avoided by determining prudential rules similar to those applicable to provident funds, thereby preventing the possibility of moral hazard. Clearly there is a case for imposing rules of risk management which would be submitted to the supervisory bodies, similar to the current norms regarding banks and brokers. It is reasonable to assume that most of the investment will be in the stock price index or in capital market indices in Israel and abroad which will be on offer in the market for this purpose. The important point regarding problems of moral hazard is that the terms of the contract are based on the stock price index and not the performance of any fund's share portfolio.

### 3. THE INSTITUTIONAL ARRANGEMENT

This section discusses the two main aspects of the proposal: a) who will comprise the entity that will insure the return to the pension funds, issue the proposed contract, and bear the risk inherent in this activity? and b) to whom is the contract addressed, or in other words, what is the process which will eventually lead to the pension funds' transferring their investments from earmarked bonds to the stock market?

Briefly, the proposed temporary intervention of the government is preferable to the currently prevailing situation, and the authors are of the opinion that it is vital, in order to start changing the current investment arrangements of pensions in Israel.

#### **The insurer**

A central question regarding the authors' proposal is which entity will insure the return to the pension funds. In principle, there is no reason that it should not be a private body, and in fact market instrument called structured notes have been developed. These are sold to pension funds by large investment houses such as Lehman Brothers and Morgan Stanley, who provide the funds with contracts similar to that proposed herein in countries such as Chile, Argentina, and Peru, which have instituted reforms in their pension system, extending investments in the tradable markets. It would be preferable for private entities to be at the forefront of the development of financial instruments such as the proposed one, but it is unlikely, taking a realistic view, that such a market will develop in Israel without government involvement, at least initially, in the provision of the insurance. It is therefore

suggested that a government-owned company, for instance Inbal, which currently deals with various types of insurance activities on behalf of the government, should handle the activity in question. The government would gradually increase the company's capital, using some of the funds which would otherwise be recorded as part of the direct subsidy to pension funds in the government's budget if earmarked bonds were still being issued.<sup>1</sup> The funds which would accumulate in the first few years would serve as the initial reserve for when the contracts start maturing. Inbal would manage the market risks it takes on itself as would a private company that manages risks. The extent of contracts offered would vary according to the level of risk which the company can carry relative to its equity capital, so that the probability that its equity capital would be eroded in its entirety and that it would also need to turn to additional budgetary sources would be minimal.<sup>2</sup> The authors estimate that according to the results of the simulation shown in Section 8, which indicate that the insurer has a positive accumulation over time, after a certain stage there will be no requirement for budgetary transfers to increase the company's capital equity. The company's cash flow will be calculated over the contract period (five years, see below), but it is proposed that the risk which the company carries itself in terms of the contracts it has offered—changes in the stock price index to which the contract is indexed, the company's assets, and the various hedging instruments it holds—should be monitored quarterly.<sup>3</sup>

Organizationally, the private sector could possibly be involved at a relatively early stage by forming a consortium of financial companies and Inbal which would engage in this activity, and at a later stage the government's share could be sold to other consortium members. Banks (domestic and foreign) could be considered as candidates for participation in such a consortium, as could foreign investment houses with expertise in this field.

The proposed government involvement, which would be temporary and market oriented, may be viewed as a catalyst in the development of financial instruments which do not currently exist in Israel. Similar intervention was exercised in the past regarding risks in the foreign-currency market, via NIS/dollar options which the Bank of Israel offers. When this activity started there were hardly any other bodies which offered similar contracts, yet currently the Bank plays only a minor role in that market. It is to be expected that financial intermediaries will in time offer contracts like those proposed herein, similar to those offered in the world's capital market.

<sup>1</sup> Assuming that the issues amounted to about NIS 180 million per year (see footnote 4), and that the subsidy constitutes 1 percentage point in the return, the saving on these issues would be NIS 15 million in the first year, and would increase by about this amount (at least) each year. When the contracts start maturing (after five years) there would already be about NIS 200 million in the fund.

<sup>2</sup> If a situation arises in which the company has to look to the budget despite monitoring and risk management, no new contracts would be issued, and a review of its overall activity would be carried out.

<sup>3</sup> The method of risk management will depend on the characteristics of the contract issued and market conditions.

## **Reducing investment in bonds earmarked for pensions**

There are several ways in which the issue of earmarked bonds paying guaranteed interest can be reduced. The issue of bonds for both old and new (i.e. formed in 1995) pension funds can be gradually reduced, or even newer funds can be formed, from a particular date, for which no earmarked bonds will be issued, and which will be permitted to invest in shares and to purchase the proposed contract. It would be preferable to bring about a gradual reduction in the investment commitment of the new (1995) funds, but this may encounter political obstacles. It is therefore proposed that from a certain date new funds be started for new participants; these funds will not be able to invest in earmarked bonds, and their investments will be directed *inter alia* to free investments in the capital market. One important proviso is that those funds entitled to earmarked bonds will not accept new members. The newest funds will purchase the proposed contracts. The 1995 funds will also be allowed to participate in the tenders for these contracts, on condition that the sums of money guaranteed under the terms of the contracts will not in future be eligible for earmarked bonds (i.e., the permitted holding in earmarked bonds will be as specified in the current arrangement, 70 percent of the balance of the accumulation in the funds originating in past and future deposits excluding the hedged amounts against purchased contracts).

At a later stage the arrangement could also incorporate old pension funds, more than 90 percent of whose investment is in earmarked bonds. Although these funds have an arrangement with the government about their actuarial deficits, so that apparently there is no incentive for them to maximize their return, the government could minimize the cost of this arrangement by improving the funds' return by means of the proposed contracts. The balances of the old funds total some NIS 90 billion, which could significantly promote the capital market once the new instrument becomes established.

If the proposal regarding the newest pension funds is accepted (with no cover from earmarked bonds), and assuming that their investments in shares "built in" to the contract would be about half of their accumulation, the annual accumulation would be about NIS 180 million, which would rise as new members joined every year.<sup>4</sup>

Although this amount is minimal relative to the size of the capital market, it will hedge the exposure of the insurer, and will allow expansion via the inclusion of the new (1995) pension funds, and possibly, in the long run, even the old pension funds.

<sup>4</sup> It is assumed that about 100,000 new workers join every year, that half of them have pension rights, that their wage is about three-quarters of the average wage, that the basis of the pension is 75 percent of the wage, and that the employer's and employee's contributions come to 18 percent.

#### 4. DETAILS OF THE CONTRACT

- 1) Two types of contract will be offered—one which guarantees a minimum return against a waiver of part of the profits (henceforth the guaranteed return/waiver contract), and a second which guarantees a given return against a waiver of part of the return above a certain maximum (henceforth a collar or minimum/ maximum contract).
- 2) The contract will be sold to the newest pension funds via a tender in which the insurer sets a minimum price. Funds' participation in the tender is voluntary, and in future the participation of other entities which deal with savings for retirement pensions (other pension funds, provident pension funds, and insurance funds) may be considered. Competition will increase with the number of participants in the tender.
- 3) The tender will be carried out for the rate of the waiver in the guaranteed return/waiver contract, and for the ceiling rate in the collar contract. For example, in the former type of contract, against a guaranteed return of 2 percent the fund will offer to waive a certain share of the profits accrued in the contract period in excess of an annual 2 percent (about 42 percent of the profit in five years). In the latter case of a collar contract the fund will waive profits in excess of the ceiling determined in the tender.
- 4) In both types of contract a minimum price will be set for the tender (a minimum rate of waiver in the guaranteed return/waiver contract, and a maximum rate in the collar contract). The minimal rate will be determined according to the B&S formula and according to the volatility and interest rates in the market, with a certain reduction to create an area of competition (see below in the section on the simulation). If there are no buyers, the minimum price can be lowered on a trial and error basis.
- 5) The contract offered is for five years. While this is a relatively short period of time when dealing with pensions, it is significantly longer than the periods in financial contracts on the current market for derivatives. As the idea is to encourage the private sector to offer long-term hedging appropriate to the funds' investment horizons, the authors are of the opinion that this a suitable initial period. A five-year period is appropriate to the average peak-trough period observed on the domestic stock market.
- 6) There are several considerations in determining the minimum guaranteed real rate:
  - (a) A zero minimum is suitable for guaranteeing a fund *plus* indexation, and to some extent describes a situation in which this component has a value, particularly if the indexation arrangements between the government and the private sector are being reduced. In this case the required degree of waiver is very low so that the funds will simultaneously bear a significant part of the risk and have the chance of making a relatively large profit.
  - (b) Guaranteeing a return close to the market rate. In this case most of the risk is transferred to the insurer, and only a small part is borne by the funds (comparable to the MIT proposal, see Section 7).
  - (c) The rate fixed should make it easy for the funds to check the actuarial situation to avoid creating excessive gaps which will require changes in members' contributions, changes which have to be made when accumulated deficits exceed a certain rate in a few years.<sup>5</sup>

<sup>5</sup> The question of accounting entries for the contract will be examined in consultation with experts in the field.

- 7) The Tel Aviv 100 Price Index (the index of the leading 100 stocks on the TASE) seems to be appropriate for the definition and for the purposes of this exercise, and is therefore proposed as the base index for the contract. The 25 Stocks Index may be too narrow, while the General Stock Price Index may incorporate components which funds cannot invest in because their listed capital may be very small, and also—because their liquidity may be too low. As the pension funds are exempt from tax on their stock-exchange investments (at the time of writing), it is advantageous to show the gross return which takes into account reinvestment of dividends. The stock exchange currently calculates the stock price index “net” (excluding the reinvestment of tax on dividends). If other indices are devised which incorporate other markets that the pension funds can invest in, such as the major foreign stock exchanges, the base index for the contracts can be changed accordingly. To illustrate this point, graph A-0 in Appendix A shows the gross return (i.e., including the investment of the tax paid on the dividend) and the Israeli shares traded in New York. As can be seen, the return including the gross dividend and the investment in Israeli shares abroad highlights even more the advantage of investing in shares and in the proposed contract.
- 8) It will be possible to transfer contracts between funds, taking into consideration the actuarial situation and the composition of the investments, and if approved by the supervisory authorities. If a fund wishes to reduce its investments in shares—given, for example, an unexpected shortening of its liabilities—there is no reason not to allow it to sell shares and in parallel to sell the contract (to another fund).

## 5. THEORETICAL PRICING OF THE CONTRACT

In this section a method of pricing both types of contract is described, based on the Black & Scholes and Merton approach (see Black and Scholes, 1973, and Merton, 1973). This approach is the currently accepted one in financial markets, and it is based on the assumption of an efficient, no-arbitrage market. Technical details of the method are given in Appendix 1. The method is appropriate for European options, with constant market volatility and constant interest rates.

**The waiver contract:** this contract guarantees a minimum return throughout the duration of the contract, in exchange for which the fund waives a part of its profit in excess of that minimum. The contract is drawn up in such a way that its initial cost is zero (as in futures contracts). If at maturity the total return from the stock market is below the minimum determined at the start of the contract, the insurer pays the pension fund the difference. If the total stock market return is above the minimum, the fund pays the insurer the agreed part of the profit in excess of the minimum. The actual pricing of the contract is fixed in a competitive tender. A graphic presentation of the contracts is given below. Figure 1(a) shows the financial payoff to the pension fund when it invests in the stock price index and in the proposed contract. The horizontal line represents the minimum guaranteed return (when the return on the stock price index is low). At a particular point the line starts rising according to the percentage of the return which remains in the hands of the fund.

This contract can be constructed as a package consisting of a purchase of a put option and sale of a particular quantity of a call option, as illustrated in Figure 1(b), where both

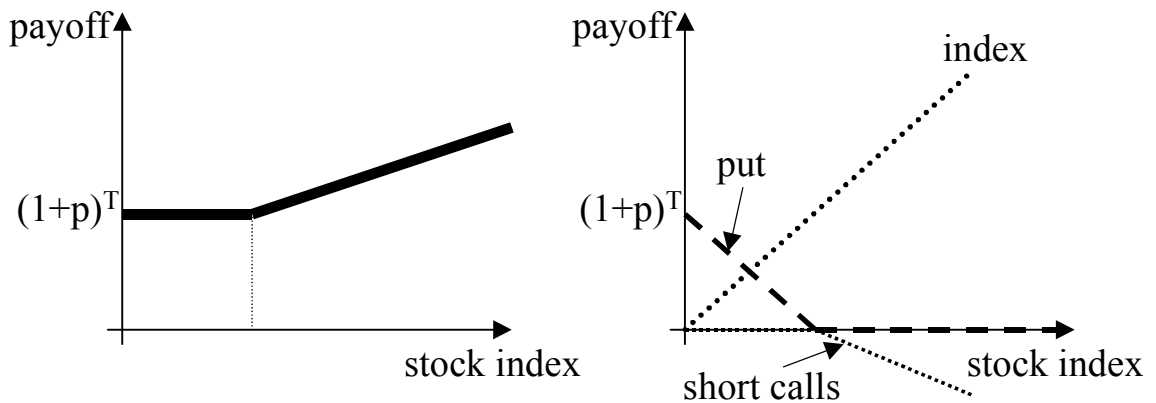
options have the same underlying asset, the same period to maturity, and the same striking price  $(1+p)^T$ . As the contract is formulated initially as a fair contract, i.e., there is no money transfer at the start of the period, the condition  $P-\alpha C = 0$  must be satisfied, i.e.,  $\alpha = P/C$ . A more detailed example of the calculation is given in Appendix 2 in which different values of  $\alpha$  are shown relating to different standard deviations and risk-free interest rates.

**The collar contract:** this contract guarantees a particular minimum return, and the pension funds waive all the return in excess of a ceiling specified in the contract. The final payoff is shown in Figure 2. In this contract the portfolio can be seen as consisting of put and call options, but in this case the quantities of both are the same, they have the same underlying asset and the same maturity, but different striking prices, as is illustrated in Figure 2(b). The striking price of the call option  $K$  which makes the initial price of the contract zero can be obtained from the following equation:

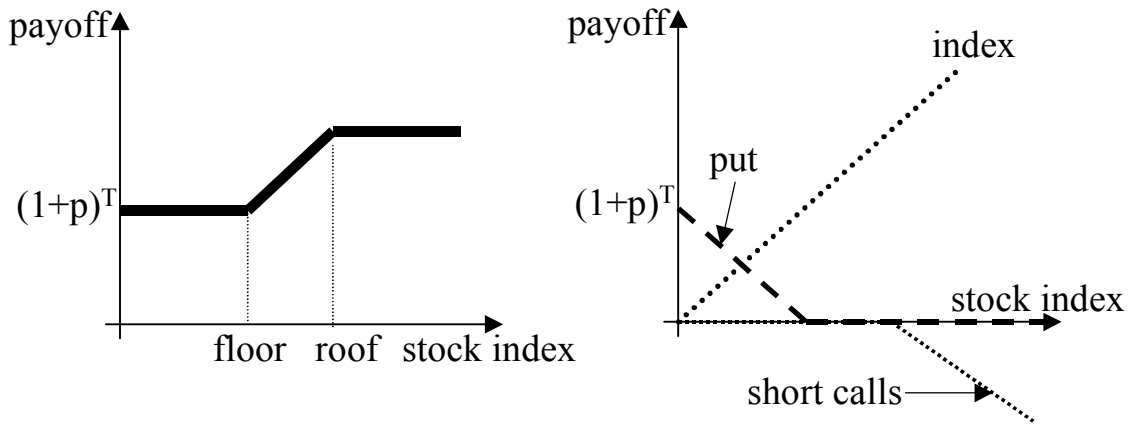
$$\text{Put}(1, (1+p)^T, T, \sigma, R) = \text{Call}(1, K, T, \sigma, R)$$

The significance of the equation is that the options which the insurer and the funds exchange between them have the same value. A quantitative example of this calculation appears in Table 1, and examples of different ceiling values for different economic values can be found in the appendices.

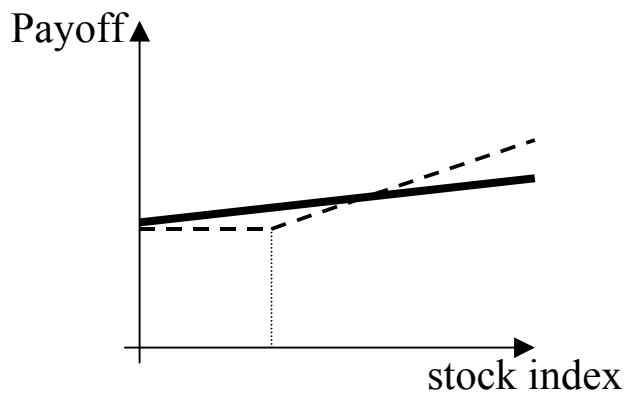
**A comparison with the current situation:** currently the pension funds may invest a small share of their resources in the free market, and most of their investments are in earmarked nontradable government bonds. Figure 3 compares the existing situation with the results of the proposed waiver contract, and the advantages and disadvantages of each can be seen. Based on experience in Israel and world wide, with long-term investments it is more worthwhile to take calculated risks with the appropriate collateral, i.e., there is a very high probability that the right side of the Figure will show that an investment strategy of significant investment in the stock market *plus* a contract is preferable to a guaranteed maximum earmarked-bonds return *plus* a minimal investment in shares.



**Figure 1**



**Figure 2**



**Figure 3**

Current scheme versus proposed contract (dotted line)

P – The minimum rate of return.



## 6. IMPLICATIONS OF IMPLEMENTING THE CONTRACT ON THE CAPITAL MARKET AND ON THE BUDGET

The following are some of the possible effects on several important economic variables of introducing the contract.

- 1) **The capital market:** extending the investment possibilities of the pension funds will increase activity in the stock market, the depth of the market, and its liquidity. The presence of additional investors, including Inbal and later on other private firms which would supply the type of insurance described above, will increase competitiveness in the market. The proposed extent of the contracts is not likely to lead to significant price rises deriving from supply side restrictions, because of the gradual rate at which investment in the stock market will expand. Even if the new (1995) funds enter the market, pressure on the domestic stock market will be moderate due to many investors' possibility of investing in shares abroad.
- 2) **The budget:**<sup>6</sup> The authors propose that the investment in the insuring company be recorded in the budget. As was stated above, the extent of the investment is the capitalized value of the subsidy which would have been paid if the issue of earmarked bonds had continued. In effect, it is proposed to advance the recording and implementation of the fiscal expenditure on the subsidy in order to accumulate capital to face the risks of the insurer's activities.

Changes in the domestic debt will depend directly on the size of the deficit, and this will change slowly with the reduction in expenditure on interest arising from the subsidy on earmarked bonds. As part of its current financing, the government will sell more tradable bonds and fewer earmarked bonds, thereby also helping to improve the functioning of the market for government bonds, which has problems of negotiability and depth of market.

The cost of total government borrowing will decline due to the reduced sales of earmarked bonds, which generally give a higher return than that on tradable bonds. Moreover, the cost of tradable bonds borrowing is expected to fall as its tradability is expected to improve. Note that in the simulations described below, the cost of proposed arrangement does not include the extra cost over time because of the more favorable return from the stock market, so that in the long run the government corporation could be privatized without raising the domestic debt burden.

- 3) The move to investments in the stock market together with the purchase of hedging contracts offered by the insurer will require the pension funds to deal with these investments either directly or through portfolio managers. This activity will entail certain expenses, but that can be financed as a result of the increased return obtained and market competition. Some funds may opt to purchase contracts against some of their investments in shares, and to bear the surplus return (and the risk incurred)

<sup>6</sup> The government budget currently shows the subsidy given in the past to the pension funds. The balance of earmarked bonds is about NIS 90 billion (mostly at 5.6 percent interest). In the budget for 2000 it was assumed that long-term interest was about 4 percent, so that the rate of subsidy to the pension funds is about 1.5 percent, which is expressed as an interest subsidy of about NIS 1.3 billion per year (at the rates of interest prevailing in the last three years, the subsidy was only 0.5 percent). (There is an additional 0.5 percent transferred to a special account to balance the actuarial position of the old pension funds, which amounts to NIS 200 million.) The future subsidy for the issue of earmarked bonds for the (old and new) pension funds for the year 2000 (capitalized to date) is estimated at NIS 700 million.

themselves. It is significant that pension funds world wide are the major investors in stock markets.

## 7. THE MIT PROPOSAL

In 1999 a proposal for reform of the pension funds in the US was put forward by economists of the Massachusetts Institute of Technology (MIT) (including Franco Modigliani), incorporating several new components of government intervention in pension reform which meld well with the current proposal. The MIT proposal related to pensions with mandatory participation, funded and managed by private concerns. Saving is of the defined benefit (DB) type, and rights accrue in personal accounts. The innovation lies in the fact that the pension funds' portfolios are invested in the stock market, and have a similar composition to that of the public's tradable-assets portfolio, and the government has a swap contract in which it guarantees a real return of 5 percent. On retirement, each member receives a pension according to the savings which have accrued in his personal account, similar to an annuity contract. The advantage of this proposal is that the fund is financially stable and immune to demographic changes, as the government (or the body managing the activity on the government's behalf) in effect bears the market risk by guaranteeing a given return against receipt of the portfolio of the market investments. It is claimed that due to the government's longer horizon, it can bear the risk over time better than can single individuals in the market.

The proposal in this paper also contains an element of transferring part of the risk from the private sector to the insurer (the government-associated entity). The advantage of this proposal lies in the fact that the transfer takes place via a contract which contains parameters determined by market conditions (i.e., the tender). Other elements in the MIT proposal, such as the transition to funded pensions, is not a crucial problem in the case of Israel (see Appendix 2), and therefore attention is focused on the pension investments, which require radical change.

## 8. THE SIMULATION

This section will describe the simulations carried out, and will use them to illustrate the advantages of the proposed contracts. The purpose of the simulation is to establish that market solutions can guarantee a return, and that the proposed market methods can provide the funds with a better return than they receive in the existing situation. The simulation shown below is based on the performance of the general stock price index in Israel in the last thirty years (see Figure 1). The results derived from the simulation using the profitability of the market route are confirmed by a calculation which takes international stock price indices into account (see Figure 4 in Appendix A).

The first stage of the simulation consists of calculating the funds' rate of waiver above the guaranteed return, and the maximum rate, according to the type of contract, as described in Section 5 and in Appendix 1. The B&S model is used for these calculations, with the following parameters: a risk-free real interest rate of 5 percent throughout the period, similar to the current real rate of interest on long-term government bonds

(calculations using 4 percent were also carried out);<sup>7</sup> and for the standard deviation of the stock market, 20 percent (the real standard deviation in the sample period was of a similar magnitude), and sensitivity tests using 10 percent and 30 percent were also performed. As was explained in Section 4, at the starting point of the contract, the “purchase” does not require any investment by the pension funds, and this is achieved by choosing the options in such a way that the funds’ receipts from selling call options equal the financial outlay on purchasing put options. New contracts are drawn up every year, i.e., every year a contract is formulated for NIS 1 which is a hedge for NIS 1 of investment in shares, and when the contracts start maturing the profits are also reinvested via the same channel (see details below).

Results are shown of the simulation in which it is assumed that the annual standard deviation is 20 percent, and risk-free real interest is 5 percent. First the funds’ waiver rates are calculated for cases where the guaranteed rate is between 0 percent and 5 percent. The rate of waiver obtained for a contract with 0 percent for a five-year period was 24.09 percent. This means that for a given guaranteed minimum (0 percent), the fund is prepared to waive about a quarter of the real return in the stock market in excess of that minimum. It can be seen from Table 1, as expected, that the higher the minimum guaranteed level, the higher will be the rate of waiver that funds are required to undertake, and that the insurer bears the greater part of the risk inherent in investing in shares.

**Table 1 Rates of waiver, minimum guaranteed rates and ceiling rates for 1 year, 5 years, and 10 years**

1 year			5 years			10 years		
Assumptions: r = 5%, s.d.= 20%			Assumptions: r = 5%, s.d.= 20%			Assumptions: r = 5%, s.d.= 20%		
Minimum return	Waiver contract	Collar contract	Minimum return	Waiver contract	Collar contract	Minimum return	Waiver contract	Collar contract
0%	53.33%	11.36%	0%	24.09%	12.25%	0%	12.94%	12.77%
1%	60.46%	10.11%	1%	32.07%	10.88%	1%	19.60%	11.36%
2%	68.46%	8.87%	2%	42.50%	9.50%	2%	29.42%	9.93%
3%	77.36%	7.66%	3%	56.08%	8.12%	3%	43.79%	8.46%
4%	87.34%	6.46%	4%	73.73%	6.72%	4%	64.75%	6.94%
5%	98.49%	5.28%	5%	96.64%	5.31%	5%	95.24%	5.34%

The results obtained for a contract of the collar type can be shown in a similar manner; with a zero percent guaranteed real return, the funds would be prepared to waive the annual return above 12.25 percent. This rate declines as the guaranteed rate rises. When the guaranteed rate approaches the market return, the ceiling rate also approaches the market rate of interest, meaning a swap contract in which all the risk in the stock market is transferred to the insurer, similar to the situation in the MIT proposal. The lower the guaranteed return, the higher the ceiling waiver rate, and the higher the share of the risk borne by the funds.

<sup>7</sup> In the B&S equations, we used continuously computed interest, while the minimum guaranteed interest rates are discrete.

The longer the term of the contract, the lower the rate of waiver. For example, in a guaranteed return/waiver contract, the rate of waiver for a one-year contract and a minimum of 0 is 53.33 percent, and falls to 24.09 percent and 12.94 percent for five- and ten-year contracts respectively. In a contract of the collar (maximum/minimum) type, the ceiling rises from 11.36 for a one-year contract to 12.25 percent and 12.77 percent for five- and ten-year contracts respectively.

In the simulation, each year the pension funds purchase one contract, investing the corresponding amount in the stock market (with a separate simulation for each type of contract). The total return is defined as that obtained when the profit is reinvested in the same channel; to check the total return of the pension funds, it is assumed that when their contracts expire they reinvest the profits in the same manner. For example, if the return at the expiry of a contract was 20 percent, the fund would purchase 1.2 new contracts. As the minimum guaranteed return is zero—repayment of the principal in real terms—the renewed contract is not less than the other contracts from the start of the simulation period. With one-year contracts the return is the accrual of the annual returns. This is a simple case, because every year a contract starts at the beginning of the year and expires at the end of the year, and there are no unexpired contracts at that time. In the case of longer contracts, say for ten years, after ten years there are nine additional open contracts with from one to ten years to expiry. When the contract is for longer than a year, and the examination is carried out annually, the situation of the portfolio which includes unexpired contracts has to be assessed. To this end a check was performed assessing the “market value” of the portfolio of unexpired contracts using the B&S model.

To calculate the pensions’ return on contracts longer than a year, the value of the portfolio at the end of the period is compared with its value at the beginning (when there were already ten contracts).<sup>8</sup> The total return for the whole of the period under review is shown in the tables in annual terms for periods of one, five, and ten years.

Table 2 gives detailed data of the pension funds’ rates of return as well as the insurer’s account from the aspect of the cash flow of payments and receipts, and the aspect of the situation of the portfolio at the end of the period (see below). As in the previous case analyzed ( $\sigma = 20\%$ ,  $r = 5\%$ ,  $p = 0\%$ ), the average annual return for a pension fund investing in shares and in a 5-year contract is 7.46 percent, in a 10-year contract, 7.79 percent, and in a 1-year contract, 9 percent (see Table A1).

In the section of Table 2 showing the insurer’s account, the accrued balance in the account is shown as well as the “market value” of the open positions of unexpired contracts. The balance is accrued from the initial situation in which the contracts were opened for period from one to ten years, as in the previous example, *plus* receipts of payments on expired options, and from accrual of interest on this balance calculated from

<sup>8</sup> The value of the portfolio at the beginning of the period is the “market value” of the unexpired contracts held by the pension funds, *plus* the value of stocks held. The beginning of the period is defined as the period when the amount of the investment was constant, increasing only as a result of profits and not of new contracts. It can be described as a hypothetical situation where there were negotiable contracts on the market, and a fund would initially purchase ten contracts (continuing the example in the text) with expiry periods of between one year and ten years. At the end of the period the fund sells the contracts, and the total accrued balance is derived from the total return on the investment.

the assumed risk-free interest (5 percent; Table A3 shows the sensitivity of the results to interest of 4 percent). (All calculations are in real terms.) The same rate of interest on positive and negative accrual of the balances in the fund was assumed. Extending the previous example to the case of a 5-year contract, with a floor of 0, the balance of open contracts from the insurer's point of view is NIS 3.32; adding to this the accrued balance of the fund (including interest) of NIS 0.17, the total obtained at the end of the period is NIS 3.49. This means in effect that on an investment flow of NIS 1 invested in a guaranteed minimum/waiver contract at the beginning of the period (with reinvestment of profits), NIS 3.49 will have accrued by the end of the period, more than three times the extent of the initial annual contracts. This balance, as stated, includes the "market value" of the open contracts.

In a contract with a maximum return with the same assumptions ( $t = 5$  years,  $\sigma = 20\%$ ,  $r = 5\%$ , and  $p = 0\%$ ), the balance of the insurer's account for a 5-year contract comes to NIS 8.46. The surplus created leads to the assessment that even if a higher ceiling is set, the funds will be able to obtain higher profits and the insurer's account will still have a certain surplus.

The results obtained regarding a collar-type contract with the same parameters ( $t = 5$  years,  $\sigma = 20\%$ ,  $r = 5\%$ , and  $p = 0\%$ ) may be described similarly: in exchange for a guaranteed minimum (0%) the funds would be prepared to waive profits above a 12.25 percent return (see also Figure A2.2b). This rate is in effect the ceiling of the contract, which would be determined by tender. In this case the funds' return would be 6.95 percent; for a 10-year contract it would be 8.08 percent, and for a one-year contract, 6.19 percent.

Results of the simulation for contracts of the waiver type and the collar type for five years are shown in Figures 2 to 5. The top part shows the insurer's flow with the value of the portfolio he is holding, and the lower part gives the funds' flows for the contract. The results are shown per contract unit, i.e., for the situation in which each year a contract for NIS 1 is opened. The insurer's annual income and expenses are also shown in terms of one contract (i.e., with no reinvestment of profit).

Table 2 Rate of pension funds' return and the insurer's account related to five – year waiver- and collar-type contracts

**Funds**

percent

Minimum return	Waiver contract		Collar contract	
	Rate of waiver	Return	Ceiling rate	Return
<b>0%</b>	24.09	7.46	12.25	6.95
<b>1%</b>	32.07	7.24	10.88	6.70
<b>2%</b>	42.50	6.93	9.50	6.38
<b>3%</b>	56.08	6.50	8.12	6.03
<b>4%</b>	73.73	5.90	6.72	5.54
<b>5%</b>	96.64	5.05	5.31	4.99

**Insurer**

NIS

Minimum return	Waiver contract			Collar contract		
	Balance of open positions	Balance of fund	TOTAL	Balance of open positions	Balance of fund	TOTAL
<b>0%</b>	3.32	0.17	<b>3.49</b>	3.85	4.61	<b>8.46</b>
<b>1%</b>	4.26	0.88	<b>5.14</b>	4.67	5.59	<b>10.26</b>
<b>2%</b>	5.35	2.15	<b>7.50</b>	5.46	6.98	<b>12.44</b>
<b>3%</b>	6.53	4.15	<b>10.67</b>	6.35	8.45	<b>14.80</b>
<b>4%</b>	7.60	7.23	<b>14.83</b>	7.28	10.23	<b>17.50</b>
<b>5%</b>	8.24	11.84	<b>20.08</b>	8.14	12.28	<b>20.42</b>

**Rate of waiver:** the rate of return which the funds waive for a given guaranteed minimum return.

**Ceiling rate:** the maximum return; profits in excess of this rate are transferred to the insurer against a given guaranteed minimum return.

**Return:** the total rate of return on an investment in shares plus a contract, in annual terms.

**Balance of open positions:** the value of open contracts priced by means of the B&S model.

**Balance of fund:** the balance which accrues from payments and receipts between the insurer and the funds, plus accrued interest.

The results are given by years of expiry, and as was expected, the funds' receipts were found to positively correlated with the years of stock-exchange peaks or troughs. The insurer's annual income and expenses enables the annual volatility of receipts to be assessed. Thus, for example, in a waiver-type contract for one year (Figure A.1) the volatility of the insurer's payments is higher than that in a longer (10-year) contract (Figure A.3). This result is even more pronounced for a collar contract.

The following figures show the cumulative account of an insurer which is appropriate to the situation of one contract being opened per year (without reinvestment of profit), including also accrual and payment of the risk-free rate of interest, in addition to the cash flows vis-à-vis the funds. The graph also shows the insurer's real value of this activity, including the value of open contracts (relevant in the case of contracts longer than one year) as well as the balance in the fund. The value of the contracts is also calculated by means of the B&S model assuming the same parameters as above, and their significance is that they describe the situation of the insurer's account at any point in time both from the aspect of cash flow as well as of open positions of the unexpired contracts. This reflect the assets/liabilities in accordance with the market conditions on the evaluation date. This means that if these contracts were negotiable and priced according to B&S, the data shown would be the balance-sheet position according to market prices on the date of evaluation.

Diagram 2a: Insurer's annual cash flow and state of fund related to the issue of waiver contracts for NIS 1 for 5 years.

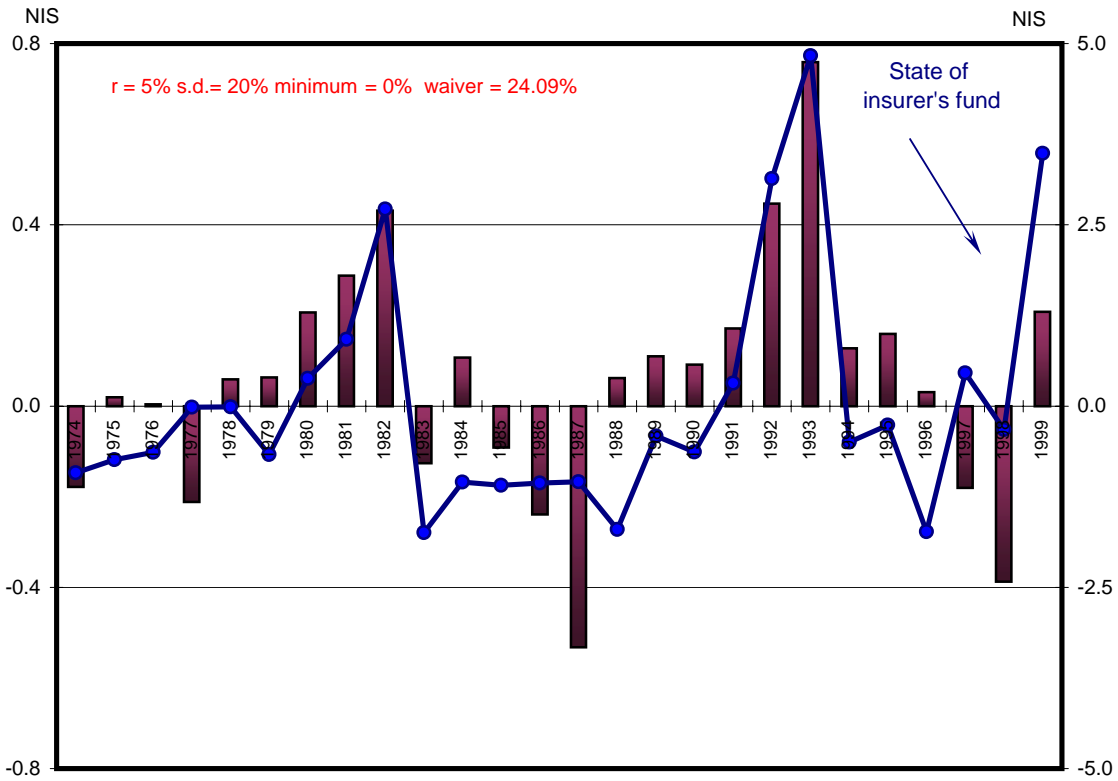
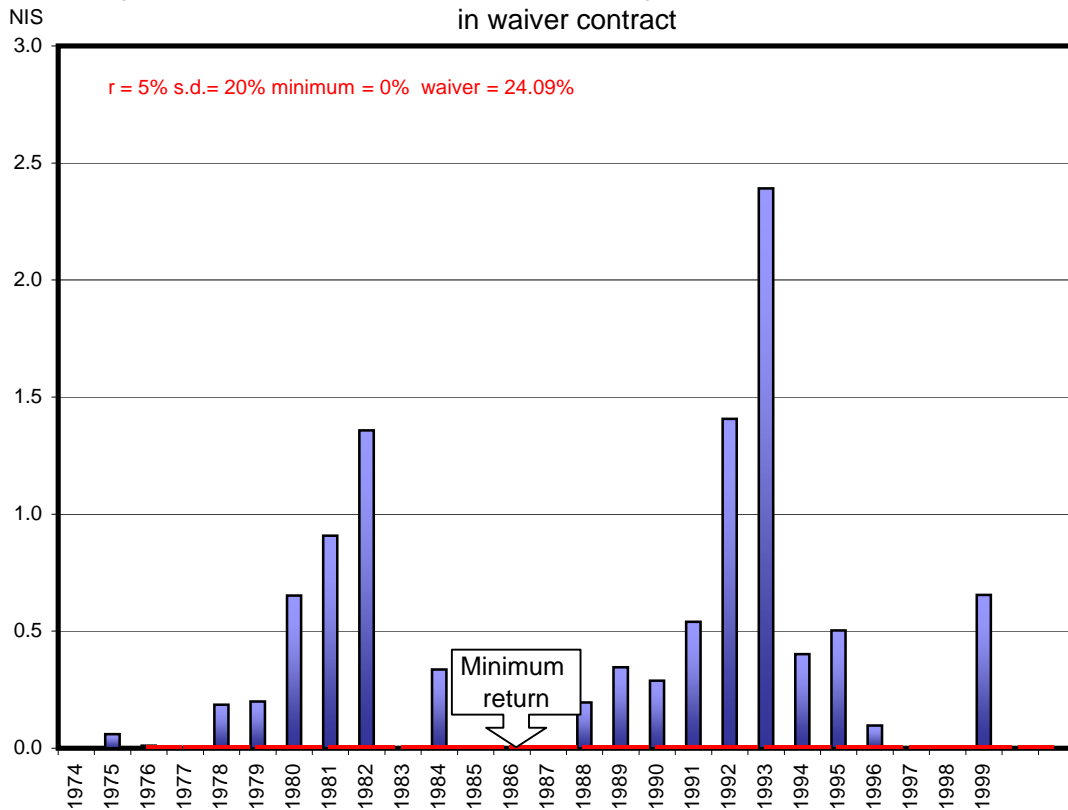
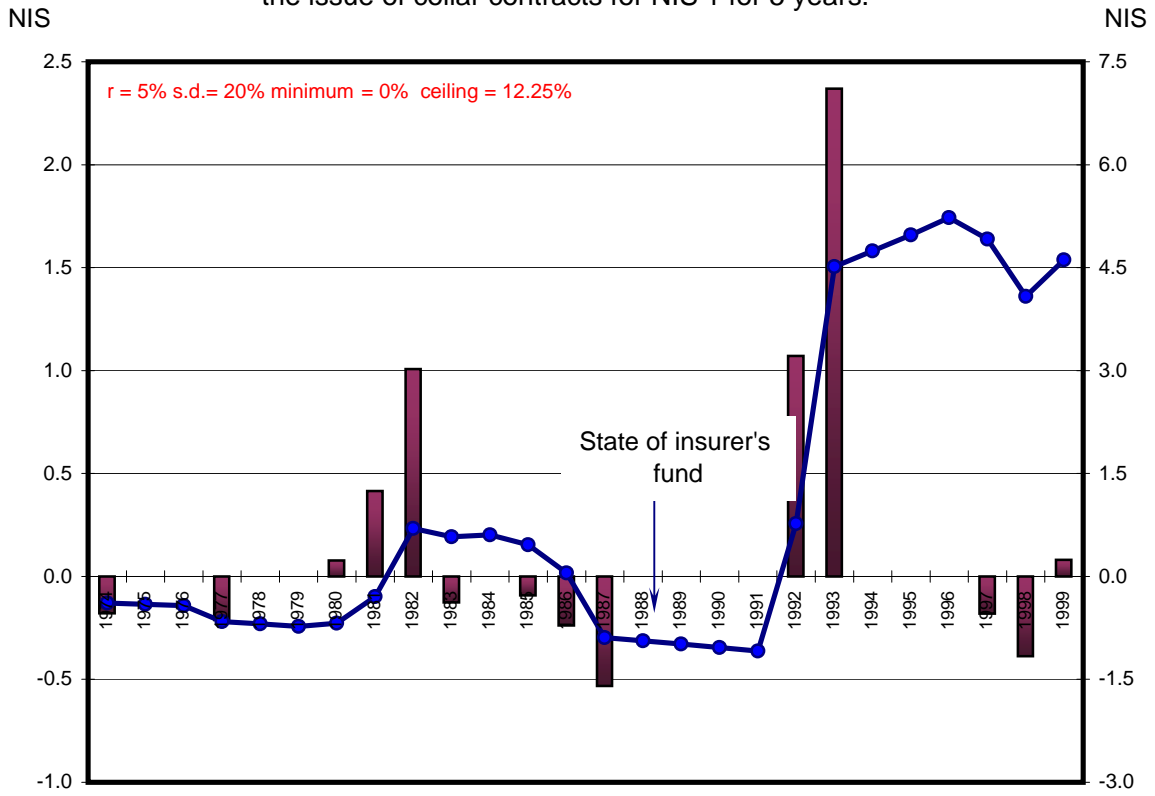


Diagram 2b: The funds' receipts from investing NIS 1 for 5 years in shares and in waiver contract

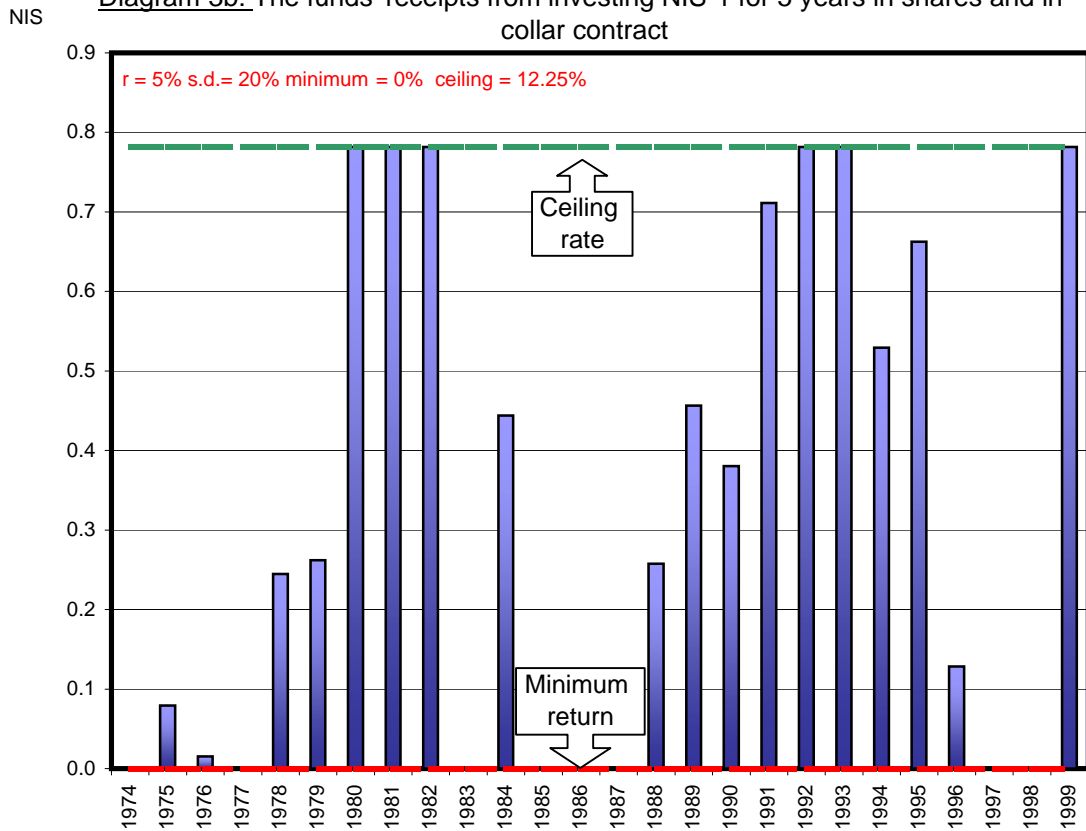




**Diagram 3a:** Insurer's annual cash flow and state of fund related to the issue of collar contracts for NIS 1 for 5 years.



**Diagram 3b:** The funds' receipts from investing NIS 1 for 5 years in shares and in collar contract



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## APPENDIX 1: THEORETICAL PRICING OF CONTRACTS

A theoretical framework for pricing the two types of contracts is shown below. It is based on the Black-Merton-Scholes approach (see Black and Scholes 1973, and Merton 1973), and will be used for evaluation and analysis of the proposed contracts.

This theoretical framework was extensively developed during the last decades. It is based on no-arbitrage and efficient-market assumptions. The general version is based on a stochastic differential equation describing prices of financial assets. The most widely used specific case of this is when volatility is constant. This case leads to analytic formulas of European put and call options, the best-known being the Black-Scholes (B&S) formula.

The following notation is used:  $T$  – time to maturity,  $r$  – continuously compounded risk-free interest rate,  $K$  – strike price of an option,  $S$  – underlying asset (stock index including all dividends gross, in this case),  $\sigma$  – volatility of the underlying asset,  $N(\cdot)$  – the cumulative normal distribution function. Then the standard option pricing formulas are given by (see Hull, page 271):

$$c = SN(d_1) - Ke^{-rT} N(d_2) \quad \text{where } d_1 = \frac{\ln \frac{S}{K} + \left( r + \frac{\sigma^2}{2} \right) T}{\sigma \sqrt{T}}, \quad d_2 = d_1 - \sigma \sqrt{T}$$

$$p = -SN(-d_1) + Ke^{-rT} N(-d_2)$$

These formulas provide the theoretical values of put and call options. As described below, we use these values for simulating results of the suggested contract during the past 30 years. In addition these formulas can be used for setting minimal auction prices for these contracts.

**Contract A** (waiver) guarantees a minimal return (or floor) for the lifetime of the contract. In exchange the pension fund will waive part of its profits above this floor. The initial value of the contract will be set at zero, as in a futures contract, so that initially there is no money transfer. At maturity the government will pay to the pension fund if the stock market return is below the floor value and will receive part of the stock market return from the fund if the return is above it, as in Figure 1. The actual price will be set at an auction for the contract. However, we provide below a theoretical framework for pricing the contract.

Figure 1 shows how one can compose a waiver contract by standard put and call options. The contract A is equivalent to a portfolio of one European put option with strike  $(1+p)^T$ , and some amount  $\alpha$  ( $0 < \alpha < 1$ ) of call options sold short on the same underlying asset and with the same strike and time to maturity. Since we wish to make the initial value of the contract zero, we initially set  $P - \alpha C = 0$ , or  $\alpha = P/C$ .

For example, if the standard deviation of yearly returns,  $\sigma$ , is 20%, and the (continuously compounded) risk-free interest rate,  $r$ , is 5%, and the promised return rate,  $p$ , is 2%, and the contract is for  $T=3$  years, then the ratio is given by:

$$\alpha = \frac{P}{C} = \frac{-SN(-d_1) + Ke^{-rT} N(-d_2)}{SN(d_1) - Ke^{-rT} N(d_2)} = \frac{-N(-d_1) + (1+p)^T e^{-rT} N(-d_2)}{N(d_1) - (1+p)^T e^{-rT} N(d_2)} = 51.69\% , \text{ where}$$

$$d_1 = \frac{\ln \frac{S}{K} + \left(r + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}} = \frac{\ln \frac{1}{(1+p)^T} + \left(r + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}} = \frac{\ln 1.02^{-3} + \left(0.05 + \frac{0.2^2}{2}\right) \cdot 3}{0.2\sqrt{3}} = 0.4347,$$

$$d_2 = d_1 - 0.2\sqrt{3} = 0.0883$$

For any chosen value of yearly volatility of the underlying asset one can easily calculate the ratio  $\alpha$ . Values of  $\alpha$  for different sets of parameters are given in Table 1.

**Contract B (Collar).** This type of contract also guarantees a minimum, but it comes in exchange for all profits above some maximum level (the ceiling). The payoff is given in Figure 2a. This contract can be presented as a portfolio of two European options: one put long and one call option sold short. The underlying asset and time to maturity of the two options are the same, but the strike of the call option is higher than the strike of the put.

The strike of the put option is defined by the promised floor. Thus the strike of the call option is used to set the initial value at zero. The strike price,  $k$ , can be found as a solution of the following equation ( $K > (1+p)^T$  must hold):

$$\text{Put}(1, (1+p)^T, T, \sigma, R) = \text{Call}(1, K, T, \sigma, R).$$

For example, if the standard deviation of yearly returns is 20%, and the (continuously compounded) risk free interest rate 5%, and the promised rate of return is 2%, and we issue a contract for 3 years, then the ceiling is given by the following equation ( $K$  is the unknown, all other variables have numerical values):

$$-N\left(\frac{-\ln \frac{1}{(1+p)^T} - \left(r + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}\right) + (1+p)^T e^{-rT} N\left(\frac{-\ln \frac{1}{(1+p)^T} - \left(r - \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}\right) = N\left(\frac{\ln \frac{1}{K} + \left(r + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}\right) - Ke^{-rT} N\left(\frac{\ln \frac{1}{K} + \left(r - \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}\right)$$

After substituting all the variables, the final equation is:

$$0.926748 = N\left(\frac{-\ln K + 0.21}{0.34641}\right) - K \cdot 0.860708 \cdot N\left(\frac{-\ln K + 0.09}{0.34641}\right).$$

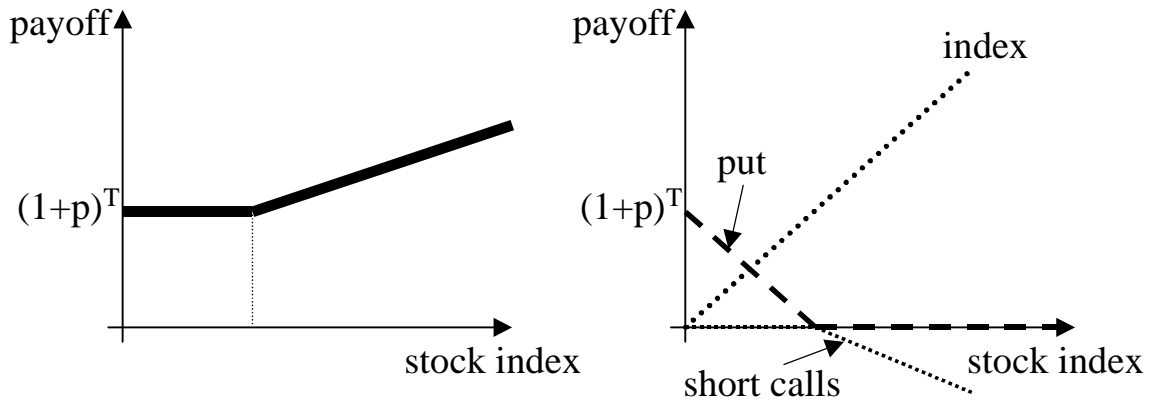
The numerical solution of this equation is  $K=1.30401$ , and the equivalent annual yield is 9.2515%.

Table 1 provides examples of values for the ceiling for various values of parameters.

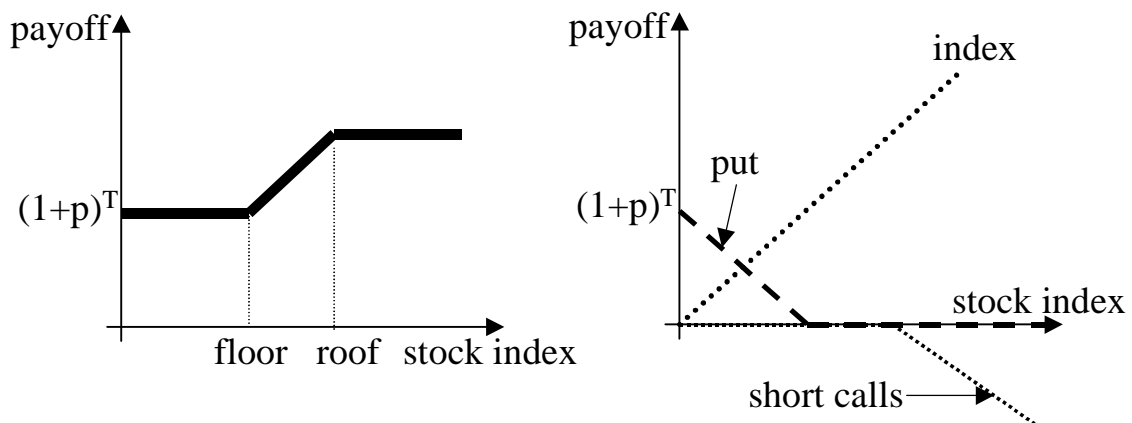
### A comparison with the current situation

Currently the pension funds may invest a small share of their resources in the free market, and most of their investments are in earmarked nontradable government bonds. Figure 3 compares

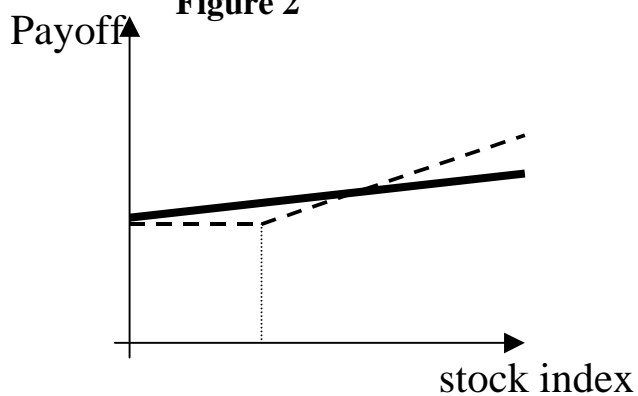
the existing situation with the results of the proposed waiver contract, and the advantages and disadvantages of each can be seen. Based on experience in Israel and world wide, with long-term investments it is more worthwhile to take calculated risks with the appropriate collateral, i.e., there is a very high probability that the right side of the Figure will show that an investment strategy of significant investment in the stock market *plus* a contract is preferable to a guaranteed maximum earmarked-bonds return *plus* a minimal investment in shares.



**Figure 1**



**Figure 2**



**Figure 3**

Current scheme versus proposed contract (dotted line)

P – The minimum rate of return

## APPENDIX 2: THE PENSION SYSTEM IN ISRAEL

Financial savings in Israel, similar to that in many other countries, rest on three main pillars:

### **Pillar 1—Compulsory savings**

Social security in Israel is compulsory, and is intended to guarantee the basic existential needs of an individual after retirement, independent of his level of savings during his working life. This pillar is based on a compulsory governmental insurance, managed by the National Insurance Institute. The allowances paid are the same for all insured persons, whereas the contributions during one's working life are a certain percentage of income. The allowance is between 15 percent and 20 percent of the average wage, a low rate by comparison with those in many advanced countries.

### **Pillar 2—Employee and employer contributions based on salaries**

This pillar is based on contributions from the employee and employer on the basis of the current wage; its purpose is to guarantee the worker a pension above the minimum covered by the first pillar. These savings are not compulsory, but constitute an important part of workers' terms of employment, and covers about half of Israel's labor force. There are several different schemes in Israel in this category—unfunded pension arrangements, funded pension funds, provident funds for retirement, and life insurance schemes. There are two types of saving: the first is of the defined benefit (DB) type, in which the fund undertakes to pay a pension which the worker receives when he retires; the second is the defined contribution (DC) type, where the pension is determined by the accrued pension savings plus accrued profits in individual accounts. The type of savings in the different pension arrangements in this second category are as follows:

Old pension funds	New pension funds	Pension funds for the self-employed	Provident funds	Life insurance schemes
DB	DB <sup>1</sup>	DC	DC	DC

*Unfunded pensions:* These apply to public-sector employees—the defense forces, the police, prison officers, teachers, and employees in several statutory corporations. At the end of the 1990s about a quarter of a million employees were insured by unfunded pensions. In this system pension and other rights are financed by the employer from his budget, unlike the situation in funded pensions, which are based on contributions by employees and employers. From the employee's point of view, unfunded pension rights are preferable to funded pension rights because of the way the salary used for pension calculations is defined, the fact that the employee does not contribute to the pension fund, salary increases are granted just prior to retirement, there are early retirement rights, etc. The Accountant-General's Report shows that the government's pension liabilities at the end of 1997 amounted to some NIS 184 billion. In an attempt to face up to this future burden, an agreement was reached in March 1995 between the Ministry of Finance

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<sup>1</sup> Nevertheless, the new pension funds are meant to operate with an actuarial balance, meaning that if they deviate from the maximum actuarial deficit permitted by law (3 percent), they must revise either the level of members' contributions or their pension rights. This leads to uncertainty regarding the rights of member who reaches retirement, which is more characteristic of DC-type savings.

and the General Federation of Labour (the Histadrut) that new employees in the public sector will only join funded pensions, but implementation of the agreement has not yet started.

*Pension funds:* Pension funds were established in Israel by the Histadrut, and were initially intended to guarantee employees' pension savings. The funds are based on contributions from the employers and employees. The obligation to join Histadrut pension funds in the different industries was written into collective agreements signed by representatives of the employees, employers, and the funds. The first pension fund for the self-employed was not established until the mid-1980s. About a third of Israel's labor force is insured by the pension funds. The main problem regarding these funds is the question of their actuarial imbalance. Although the funds benefited from investing 93 percent of money they accumulated in earmarked bonds which were issued specifically for them outside the capital market with a fixed real annual rate of interest of 5.56 percent, which includes a subsidy amounting to between 1 percentage point and 1.5 percentage points a year in terms of the return, the Histadrut funds went into deficit which reached NIS 53 billion in 1996.<sup>2</sup> There are several reasons for the actuarial deficits, including demographic changes, a rise in the dependency ratio (due to a rise in life expectancy and a reduction in the number of working years), pension benefits, and the method of accrual of rights without ensuring an appropriate actuarial balance. The world wide problem of the rise in the dependency ratio is aggravated in Israel's case by immigration. As Israel is a country which encourages immigration, pension funds pay relatively high rates of pension also to those who have accumulated rights over only a few years. To tackle the problem of the actuarial deficit, an agreement was signed in 1995 between the Ministry of Finance and the Histadrut according to which the old pension funds would not accept new members (existing members continue to accumulate pension rights in those funds). At the same time new pension funds were established, which are intended to operate on a basis of an actuarial balance. Actuarial checks are performed once every three years, and any fund exceeding the predetermined permitted deficit must adjust the pension parameters—increase the contributions or reduce the rights—to return to an actuarial balance. To date no such revisions have been performed. These funds are based on the purchase of “pension portions” in such a way that the pension at retirement age equals the accrued annual pension portions. The new funds must hold 70 percent of their assets in earmarked bonds, which yield a return of 5.05 percent a year, below that obtained by the old funds, but still incorporating a subsidy. At the end of 1997 the new funds had 349,000 members, with total accumulated funds of NIS 2.17 billion, compared with NIS 94 billion in the old funds. By the end of 1998 the number of members of new funds had risen to 440,000, and their accumulated funds had grown to NIS 3.75 billion.<sup>2</sup>

*Life insurance:* Life insurance guarantees the beneficiary an income or payment in the event of the realization of the risk against which he has insured (e.g., death, loss of ability to work) or at the end of the insurance period. There are several types of policy:

- Individual insurance: Life insurance intended for the self-employed and for employees who purchase it independent of their employers.
- Managers' and employees' insurance: This insurance is based on employee/employer relations and on the contributions of both to cover various risks (e.g., death, loss of ability to work), and its major component is pension savings. This arrangement earns employers and

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<sup>2</sup> Source: Annual Reports of the Commissioner of the Capital Market, Insurance, and Savings, 1996 to 1998.

employees certain tax benefits. The State Comptroller found that fees on these savings are high relative to those on other savings channels.

- **Collective insurance:** Insurance for a group of people with something in common which justifies a joint agreement, such as insurance for members of provident funds.
- **Mutual insurance:** insurance on a partnership basis.

*Provident funds:* Provident funds are instruments for accumulating benefits and compensation payments; they developed in the past mainly as a channel for the self-employed. Unlike pension funds and life insurance schemes, the sum of the insurance covers is limited and is not a major component. Provident funds also serve as a complementary saving channel for members of pension funds and life insurances. Most of the provident funds are managed by the commercial banks, in contrast to the pension funds, which are run by the Histadrut. Members may withdraw the sums they have accrued in a provident fund, either as a lump sum or as a monthly pension with full tax benefits, after only fifteen years of accrual. The monthly allowance is paid for a calculated period of time according to the actual balance of the savings (similar to a DC fund) and is not defined in the same way as a pension from a pension fund or from an insurance scheme, which is a life long allowance. Savings accounts in provident funds are inheritable.

### **Pillar 3—voluntary savings**

The third level consists of voluntary savings by an individual, with no government involvement or support. Examples of these are savings in bank savings schemes and in mutual funds.

### **Taxation of pension savings**

The state and private individuals have a joint interest in the existence of pension savings. Individuals want to maintain their standard of living when they retire, and the state wants to prevent their becoming a burden on the budget and on society. Savings institutions in the advanced economies, including Israel, are therefore granted governmental support, expressed mainly in the form of tax benefits.

Pension savings have three stages: the contribution stage, the accumulation stage, and the withdrawal stage. Pension savings in Israel receive tax benefits at each of the three stages.

- *Benefits on deposits*
  - a) Employee's contributions are tax exempt, reducing his income tax payments.
  - b) The employee is not liable for tax on his employer's contributions on his behalf, although they are recognized as expenses in the employer's tax calculations.
- *Benefits during accumulation:* The accumulation is tax exempt.
- *Benefits at withdrawal*
  - a) Withdrawal from the funds are partially exempt from tax, although as stated they served as a basis for tax credit when contributions were made.
  - b) The accumulation is partially exempt from tax also at withdrawal.

These tax benefits are given on contributions at a certain percentage of salary up to certain maximums, shown in the following table.



## Rate of contribution entitled to taxation relief on long-term savings<sup>3</sup>

	Rate of contribution (percentage)			Taxation				
				At time of contribution			Withdrawal	
	Provident fund	New comprehensive fund	Managers' insurance	Tax benefit	Ceiling without splitting	Ceiling with splitting	Tax benefit	Ceiling
<u>Employer</u> 1.compensation	8.33	8.33	8.33	Exempt	None	None	Exempt	9,300 per year
<u>Employer</u> 2.pension	5	0	5	Exempt	9,300	Combined ceiling	Exempt	None
<u>Employer</u> or Allowance <sup>1</sup>	---	6	5	Exempt	25,388	34,688	Note 3	
3. Loss of ability to work <sup>2</sup>	0	0	2.5	Exempt	None	None		
<u>Employee</u> <sup>4</sup>	5	5.5	5	Pension fund: 35% credit Managers' pension insurance: 25% credit	9,300	9,300	Note 5	
<b>Total</b>	<b>18.33</b>	<b>19.83</b>	<b>20.83</b>					

1. A comprehensive pension is only paid as an allowance.
2. In managers' insurance an additional contribution of 2.5 percent is permitted (generally paid by the employer) to purchase cover of loss of ability to work.
3. The higher of:
  - (a) Tax exempt in the allowance which derives from the employee's contributions and contributions which did not receive tax benefits;
  - (b) Thirty five percent of the allowance up to a maximum of NIS 6,300 per month.
4. In addition a deduction (and thus credit) of up to 5 percent of his salary is permitted, which does not constitute a basis for the employer's contribution, up to a maximum of NIS 9,300 per month.
5. This sum is exempt in the allowance channel. Regarding the pension channel, see note 3.

<sup>3</sup> Source: The Report of the Public Committee for Tax Reform (2000) (The Ben Bassat Committee Report).

## APPENDIX—TABLES AND FIGURES

### **Tables**

A1 to A3: The sensitivity of the results of the simulation to the length of contract, the standard deviation, and relevant market rate of interest.

A4.1 to A4.3: Year by year details of waiver- and collar-type contracts for 1, 5, and 10 years.

A5: Returns and standard deviations on the funds' investments in shares and in contracts.

### **Figures**

A.0: The general stock price index adjusted to gross dividend and to Israeli shares traded in New York

A1.1 to A2.3:

a) Distribution of annual cash flow and the state of the insurer's fund per contract unit related to the issue of waiver- and collar-type contracts for 1, 5, and 10 years.

b) Funds' receipts per contract unit for waiver- and collar-type contracts for 1, 5, and 10 years.

Table A.1 Sensitivity of the results of the simulation for 1-year, 5-year and 10-year contracts

( $r = 5\%$ ,  $s.d. = 20\%$ )

**Funds**  
percent

$t = 1$

Minimum return	Waiver contract		Collar contract	
	Rate of waiver	Return	Ceiling rate	Return
<b>0%</b>	53.33	9.06	11.36	6.19
<b>1%</b>	60.46	8.45	10.11	5.95
<b>2%</b>	68.43	7.76	8.87	5.71
<b>3%</b>	77.36	6.98	7.66	5.46
<b>4%</b>	87.34	6.10	6.46	5.25
<b>5%</b>	98.49	5.09	5.28	4.99

**Insurer**  
NIS

$t = 1$

Minimum return	Waiver contract			Collar contract		
	Balance of open positions	Balance of fund	TOTAL	Balance of open positions	Balance of fund	TOTAL
<b>0%</b>	0.00	4.52	<b>4.52</b>	0.00	8.58	<b>8.58</b>
<b>1%</b>	0.00	5.78	<b>5.78</b>	0.00	8.77	<b>8.77</b>
<b>2%</b>	0.00	6.92	<b>6.92</b>	0.00	8.93	<b>8.93</b>
<b>3%</b>	0.00	7.90	<b>7.90</b>	0.00	9.08	<b>9.08</b>
<b>4%</b>	0.00	8.70	<b>8.70</b>	0.00	9.22	<b>9.22</b>
<b>5%</b>	0.00	9.30	<b>9.30</b>	0.00	9.35	<b>9.35</b>

**Funds**  
percent

$t = 5$

Minimum return	Waiver contract		Collar contract	
	Rate of waiver	Return	Ceiling rate	Return
<b>0%</b>	24.09	7.46	12.25	6.95
<b>1%</b>	32.07	7.24	10.88	6.70
<b>2%</b>	42.50	6.93	9.50	6.38
<b>3%</b>	56.08	6.50	8.12	6.03
<b>4%</b>	73.73	5.90	6.72	5.54
<b>5%</b>	96.64	5.05	5.31	4.99

**Insurer**  
NIS

$t = 5$

Minimum return	Waiver contract			Collar contract		
	Balance of open positions	Balance of fund	TOTAL	Balance of open positions	Balance of fund	TOTAL
<b>0%</b>	3.32	0.17	<b>3.49</b>	3.85	4.61	<b>8.46</b>
<b>1%</b>	4.26	0.88	<b>5.14</b>	4.67	5.59	<b>10.26</b>
<b>2%</b>	5.35	2.15	<b>7.50</b>	5.46	6.98	<b>12.44</b>
<b>3%</b>	6.53	4.15	<b>10.67</b>	6.35	8.45	<b>14.80</b>
<b>4%</b>	7.60	7.23	<b>14.83</b>	7.28	10.23	<b>17.50</b>
<b>5%</b>	8.24	11.84	<b>20.08</b>	8.14	12.28	<b>20.42</b>

**Funds**  
percent

$t = 10$

Minimum return	Waiver contract		Collar contract	
	Rate of waiver	Return	Ceiling rate	Return
<b>0%</b>	12.94	7.79	12.77	8.08
<b>1%</b>	19.60	7.38	11.36	7.79
<b>2%</b>	29.42	6.93	9.93	7.43
<b>3%</b>	43.79	6.41	8.46	6.96
<b>4%</b>	64.75	5.80	6.94	6.16
<b>5%</b>	95.24	4.99	5.34	5.04

**Insurer**  
NIS

$t = 10$

Minimum return	Waiver contract			Collar contract		
	Balance of open positions	Balance of fund	TOTAL	Balance of open positions	Balance of fund	TOTAL
<b>0%</b>	2.84	6.04	<b>8.89</b>	3.18	3.06	<b>6.25</b>
<b>1%</b>	3.76	7.81	<b>11.57</b>	4.64	3.55	<b>8.19</b>
<b>2%</b>	4.89	9.67	<b>14.55</b>	6.60	4.53	<b>11.13</b>
<b>3%</b>	6.41	11.60	<b>18.01</b>	8.95	5.95	<b>14.90</b>
<b>4%</b>	8.56	13.57	<b>22.13</b>	11.11	9.77	<b>20.88</b>
<b>5%</b>	11.76	15.96	<b>27.72</b>	12.26	15.44	<b>27.70</b>

Rate of waiver: the rate of return which the funds waive for a given guaranteed minimum return

Ceiling rate: the maximum return; profits in excess of this rate are transferred to the insurer against a given guaranteed minimum return

Return: the total rate of return on an investment in shares plus a contract, in annual terms

Balance of open positions: the value of open contracts priced by means of the B&S model (with a 1-year contract, all the contracts expire, so that their value is zero).

Balance of fund: the balance which accrues from payments and receipts between the insurer and the funds, plus accrued interest

Table A.2 Sensitivity of the results of the simulation for the standard deviation

( $r = 5\%$ ,  $t = 5$  years)

Funds

Insurer

s.d. = 20%

percent

s.d. = 20%

NIS

Minimum return	Waiver contract		Collar contract	
	Rate of waiver	Return	Ceiling rate	Return
<b>0%</b>	24.09	7.46	12.25	6.95
<b>1%</b>	32.07	7.24	10.88	6.70
<b>2%</b>	42.50	6.93	9.50	6.38
<b>3%</b>	56.08	6.50	8.12	6.03
<b>4%</b>	73.73	5.90	6.72	5.54
<b>5%</b>	96.64	5.05	5.31	4.99

Minimum return	Waiver contract			Collar contract		
	Balance of open positions	Balance of fund	TOTAL	Balance of open positions	Balance of fund	TOTAL
<b>0%</b>	3.32	0.17	<b>3.49</b>	3.85	4.61	<b>8.46</b>
<b>1%</b>	4.26	0.88	<b>5.14</b>	4.67	5.59	<b>10.26</b>
<b>2%</b>	5.35	2.15	<b>7.50</b>	5.46	6.98	<b>12.44</b>
<b>3%</b>	6.53	4.15	<b>10.67</b>	6.35	8.45	<b>14.80</b>
<b>4%</b>	7.60	7.23	<b>14.83</b>	7.28	10.23	<b>17.50</b>
<b>5%</b>	8.24	11.84	<b>20.08</b>	8.14	12.28	<b>20.42</b>

s.d. = 10%

percent

s.d. = 10%

NIS

Minimum return	Waiver contract		Collar contract	
	Rate of waiver	Return	Ceiling rate	Return
<b>0%</b>	5.56	8.92	11.16	6.89
<b>1%</b>	10.11	8.87	9.98	6.59
<b>2%</b>	18.01	8.66	8.81	6.27
<b>3%</b>	31.54	8.19	7.64	5.92
<b>4%</b>	54.54	7.21	6.46	5.45
<b>5%</b>	93.43	5.29	5.28	4.98

Minimum return	Waiver contract			Collar contract		
	Balance of open positions	Balance of fund	TOTAL	Balance of open positions	Balance of fund	TOTAL
<b>0%</b>	0.99	-7.74	<b>-6.75</b>	3.30	6.25	<b>9.54</b>
<b>1%</b>	1.80	-8.30	<b>-6.51</b>	4.14	7.27	<b>11.41</b>
<b>2%</b>	3.10	-7.81	<b>-4.71</b>	5.04	8.34	<b>13.38</b>
<b>3%</b>	5.01	-5.46	<b>-0.45</b>	6.04	9.50	<b>15.55</b>
<b>4%</b>	7.23	0.14	<b>7.37</b>	7.09	10.85	<b>17.94</b>
<b>5%</b>	8.36	10.75	<b>19.12</b>	8.12	12.35	<b>20.47</b>

s.d. = 30%

percent

s.d. = 30%

NIS

Minimum return	Waiver contract		Collar contract	
	Rate of waiver	Return	Ceiling rate	Return
<b>0%</b>	38.48	6.26	13.58	7.04
<b>1%</b>	46.58	6.09	11.97	6.81
<b>2%</b>	56.24	5.88	10.34	6.51
<b>3%</b>	67.75	5.63	8.70	6.15
<b>4%</b>	81.45	5.33	7.04	5.64
<b>5%</b>	97.72	4.97	5.34	5.00

Minimum return	Waiver contract			Collar contract		
	Balance of open positions	Balance of fund	TOTAL	Balance of open positions	Balance of fund	TOTAL
<b>0%</b>	4.17	5.39	<b>9.56</b>	4.53	2.69	<b>7.23</b>
<b>1%</b>	4.91	6.03	<b>10.94</b>	5.33	3.73	<b>9.06</b>
<b>2%</b>	5.72	6.92	<b>12.64</b>	6.09	5.25	<b>11.34</b>
<b>3%</b>	6.60	8.13	<b>14.72</b>	6.81	7.15	<b>13.96</b>
<b>4%</b>	7.45	9.82	<b>17.27</b>	7.55	9.49	<b>17.03</b>
<b>5%</b>	8.18	12.20	<b>20.38</b>	8.18	12.20	<b>20.38</b>

Rate of waiver: the rate of return which the funds waive for a given guaranteed minimum return.

Ceiling rate: the maximum return; profits in excess of this rate are transferred to the insurer against a given guaranteed minimum return.

Return: the total rate of return on an investment in shares plus a contract, in annual terms.

Balance of open positions: the value of open contracts priced by means of the B&S model.

Balance of fund: the balance which accrues from payments and receipts between the insurer and the funds, plus accrued interest.

Table A.3 Sensitivity of the results of the simulation for the interest rate

(t = 5 years, s.d.= 20%)

**Funds**

*r* = 5%      percent

Minimum return	Waiver contract		Collar contract	
	Rate of waiver	Return	Ceiling rate	Return
<b>0%</b>	24.09	7.46	12.25	6.95
<b>1%</b>	32.07	7.24	10.88	6.70
<b>2%</b>	42.50	6.93	9.50	6.38
<b>3%</b>	56.08	6.50	8.12	6.03
<b>4%</b>	73.73	5.90	6.72	5.54
<b>5%</b>	96.64	5.05	5.31	4.99

**Insurer**

*r* = 5%      NIS

Minimum return	Waiver contract			Collar contract		
	Balance of open positions	Balance of fund	TOTAL	Balance of open positions	Balance of fund	TOTAL
<b>0%</b>	3.32	0.17	<b>3.49</b>	3.85	4.61	<b>8.46</b>
<b>1%</b>	4.26	0.88	<b>5.14</b>	4.67	5.59	<b>10.26</b>
<b>2%</b>	5.35	2.15	<b>7.50</b>	5.46	6.98	<b>12.44</b>
<b>3%</b>	6.53	4.15	<b>10.67</b>	6.35	8.45	<b>14.80</b>
<b>4%</b>	7.60	7.23	<b>14.83</b>	7.28	10.23	<b>17.50</b>
<b>5%</b>	8.24	11.84	<b>20.08</b>	8.14	12.28	<b>20.42</b>

*r* = 4%      percent

Minimum return	Waiver contract		Collar contract	
	Rate of waiver	Return	Ceiling rate	Return
<b>0%</b>	32.12	6.79	9.77	6.10
<b>1%</b>	42.68	6.39	8.39	5.71
<b>2%</b>	56.47	5.85	7.01	5.21
<b>3%</b>	74.44	5.10	5.61	4.62
<b>4%</b>	97.82	4.03	4.20	3.98

*r* = 4%      NIS

Minimum return	Waiver contract			Collar contract		
	Balance of open positions	Balance of fund	TOTAL	Balance of open positions	Balance of fund	TOTAL
<b>0%</b>	3.85	2.92	<b>6.77</b>	4.24	7.88	<b>12.12</b>
<b>1%</b>	4.77	4.39	<b>9.15</b>	4.86	9.37	<b>14.23</b>
<b>2%</b>	5.70	6.57	<b>12.26</b>	5.51	11.08	<b>16.60</b>
<b>3%</b>	6.48	9.66	<b>16.14</b>	6.16	12.83	<b>18.99</b>
<b>4%</b>	6.76	14.04	<b>20.80</b>	6.72	14.37	<b>21.08</b>

Market rate of interest: interest included in the model for purposes of calculating the B&S model as risk-free interest and as interest accrued on the balance of the insurer's fund.

Rate of waiver: the rate of return which the funds waive for a given guaranteed minimum return.

Ceiling rate: the maximum return; profits in excess of this rate are transferred to the insurer against a given guaranteed minimum return.

Return: the total rate of return on an investment in shares plus a contract, in annual terms.

Balance of open positions: the value of open contracts priced by means of the B&S model.

Balance of fund: the balance which accrues from payments and receipts between the insurer and the funds, plus accrued interest.

Table A.4.1 Analysis of collar contracts and 1-year waiver contracts

Assumptions: r =5%, s.d. = 20%, floor = 3%			Waiver contract			Collar contract		
Year	General share price index	Return over contract period (%)	Value of funds' portfolio <sup>1</sup>	Insurer's receipts/ payments at end of contract	state of insurer's fund	Value of funds' portfolio <sup>1</sup>	Insurer's receipts/ payments at end of contract	state of insurer's fund
1970	84.69	-15.31	1.03	-0.18	-0.18	1.03	-0.18	-0.18
1971	96.22	13.61	1.09	0.08	-0.11	1.11	0.06	-0.13
1972	166.66	73.20	1.29	0.59	0.48	1.19	0.73	0.59
1973	109.24	-34.45	1.33	-0.48	0.02	1.23	-0.45	0.17
1974	82.17	-24.78	1.37	-0.37	-0.35	1.27	-0.34	-0.16
1975	91.41	11.24	1.44	0.09	-0.28	1.36	0.05	-0.12
1976	97.69	6.86	1.49	0.04	-0.25	1.46	0.00	-0.13
1977	131.45	34.57	1.64	0.36	0.10	1.57	0.39	0.26
1978	135.96	3.43	1.69	0.01	0.11	1.62	0.00	0.27
1979	103.72	-23.71	1.74	-0.45	-0.34	1.67	-0.43	-0.15
1980	169.93	63.84	2.04	0.82	0.47	1.80	0.94	0.78
1981	214.53	26.25	2.21	0.37	0.86	1.94	0.33	1.15
1982	366.69	70.93	2.61	1.16	2.06	2.09	1.23	2.44
1983	118.84	-67.59	2.69	-1.84	0.32	2.15	-1.47	1.09
1984	149.75	26.00	2.91	0.48	0.81	2.31	0.39	1.53
1985	154.37	3.08	3.00	0.00	0.85	2.38	0.00	1.61
1986	163.30	5.79	3.11	0.06	0.96	2.52	0.00	1.69
1987	171.59	5.07	3.21	0.05	1.06	2.65	0.00	1.78
1988	149.48	-12.88	3.31	-0.51	0.60	2.73	-0.42	1.44
1989	218.08	45.89	3.73	1.10	1.73	2.94	1.04	2.56
1990	213.10	-2.28	3.84	-0.20	1.62	3.03	-0.16	2.53
1991	279.43	31.12	4.20	0.84	2.54	3.26	0.71	3.37
1992	489.62	75.22	5.02	2.35	5.01	3.51	2.20	5.74
1993	620.42	26.71	5.44	0.92	6.18	3.78	0.67	6.69
1994	333.48	-46.25	5.60	-2.68	3.82	3.89	-1.86	5.17
1995	354.27	6.23	5.81	0.14	4.15	4.13	0.00	5.43
1996	315.30	-11.00	5.98	-0.81	3.54	4.26	-0.58	5.12
1997	401.20	27.24	6.49	1.12	4.84	4.58	0.83	6.21
1998	379.94	-5.30	6.69	-0.54	4.54	4.72	-0.38	6.14
1999	621.12	63.48	7.80	3.13	7.90	5.08	2.63	9.08

1. From the start of the simulation period (1969) the pension funds invested NIS 1 in the share price index and concurrently entered into an insurance contract which guaranteed them a 3 percent annual return. This column shows the value of the funds' inve

Table A.4.2 Analysis of collar contracts and waiver 5-year waiver contracts

Assumptions: =5%, s.d. = 20%, floor = 3%			Waiver contract					Collar contract				
Year	General share price index	Return over contract period (%)	Funds' receipts at end of contract	Value of funds' portfolio	Insurer's receipts/payments at end of contract	state of insurer's fund	Value of insurer's portfolio	Funds' receipts at end of contract	Value of funds' portfolio	Insurer's receipts/payments at end of contract	state of insurer's fund	Value of insurer's portfolio
1974	82.17	-17.83%	0.16	5.31	-0.34	-0.55	-1.63	0.16	5.35	-0.34	-0.65	-1.77
1975	91.41	7.93%	0.16	5.58	-0.08	-0.65	-1.45	0.16	5.61	-0.08	-0.76	-1.59
1976	97.69	1.52%	0.16	5.84	-0.14	-0.83	-1.41	0.16	5.89	-0.14	-0.94	-1.57
1977	131.45	-21.13%	0.16	6.55	-0.37	-1.24	-0.35	0.16	6.54	-0.37	-1.36	-0.45
1978	135.96	24.46%	0.20	6.79	0.05	-1.26	-0.39	0.24	6.88	0.00	-1.43	-0.61
1979	103.72	26.22%	0.40	6.36	0.07	-1.25	-1.84	0.46	6.58	0.00	-1.50	-2.21
1980	169.93	85.89%	0.70	7.78	0.45	-0.86	0.35	0.71	7.84	0.44	-1.13	0.21
1981	214.53	119.61%	0.87	8.91	0.67	-0.23	1.55	0.71	8.61	0.83	-0.36	1.79
1982	366.69	178.95%	1.17	12.30	1.06	0.82	5.73	0.71	9.57	1.52	1.15	8.45
1983	118.84	-12.59%	0.39	8.72	-0.34	0.52	-2.28	0.44	8.34	-0.35	0.85	-1.67
1984	149.75	44.38%	0.79	9.36	0.22	0.77	-1.36	1.11	9.13	0.00	0.89	-0.90
1985	154.37	-9.16%	0.97	9.78	-0.43	0.38	-1.51	0.99	9.56	-0.43	0.51	-1.06
1986	163.30	-23.88%	1.17	10.24	-0.75	-0.35	-1.50	0.99	10.08	-0.68	-0.15	-1.09
1987	171.59	-53.21%	1.52	10.70	-1.50	-1.87	-1.52	0.99	10.64	-1.18	-1.34	-1.20
1988	149.48	25.78%	0.67	10.58	0.08	-1.88	-2.92	0.81	10.53	0.00	-1.41	-2.54
1989	218.08	45.63%	1.31	12.21	0.30	-1.68	-0.26	2.08	12.45	0.00	-1.48	-0.22
1990	213.10	38.05%	1.48	12.37	0.24	-1.52	-0.81	1.74	12.96	0.00	-1.55	-1.12
1991	279.43	71.11%	2.04	14.21	0.67	-0.92	1.34	1.93	14.62	0.46	-1.16	1.31
1992	489.62	185.35%	3.80	19.73	2.39	1.42	8.16	1.93	16.47	2.73	1.51	12.27
1993	620.42	315.05%	3.13	23.09	2.80	4.29	11.95	1.68	17.59	4.85	6.44	18.49
1994	333.48	52.92%	2.06	18.53	0.48	4.99	2.51	3.55	17.25	0.16	6.92	5.44
1995	354.27	66.24%	2.42	19.42	0.70	5.94	2.87	3.05	18.31	0.51	7.77	5.71
1996	315.30	12.84%	2.53	19.76	-0.09	6.14	1.02	2.40	18.40	-0.09	8.07	4.22
1997	401.20	-18.06%	4.56	21.29	-1.63	4.82	3.79	2.40	20.00	-1.00	7.47	7.00
1998	379.94	-38.76%	3.78	21.67	-2.26	2.80	2.58	2.11	20.50	-1.47	6.38	5.83
1999	621.12	86.26%	3.49	27.33	1.21	4.15	10.67	5.72	24.52	1.75	8.45	14.80

Table A.4.3 Analysis of collar contracts and 10-year waiver contracts

Assumptions: =5%, s.d. = 20%, floor = 3%			Waiver contract					Collar contract				
Year	General share price index	Return over contract period (%)	Funds' receipts at end of contract	Value of funds' portfolio	Insurer's receipts/payments at end of contract	state of insurer's fund	Value of insurer's portfolio	Funds' receipts at end of contract	Value of funds' portfolio	Insurer's receipts/payments at end of contract	state of insurer's fund	Value of insurer's portfolio
1979	103.72	3.72%	0.34	11.64	-0.31	0.27	-1.14	0.34	11.91	-0.31	-0.08	-1.76
1980	169.93	100.64%	0.72	14.67	0.29	0.58	2.38	1.01	15.11	0.00	-0.08	1.57
1981	214.53	122.95%	0.84	17.08	0.39	0.99	4.32	1.23	17.32	0.00	-0.09	3.75
1982	366.69	120.02%	0.83	25.16	0.37	1.42	10.75	1.20	20.99	0.00	-0.09	15.08
1983	118.84	8.79%	0.34	14.10	-0.26	1.23	-1.43	0.34	15.47	-0.26	-0.35	-3.85
1984	149.75	82.24%	0.61	15.56	0.21	1.50	0.14	0.82	17.33	0.00	-0.37	-2.61
1985	154.37	68.87%	0.54	16.13	0.15	1.73	0.09	0.69	18.04	0.00	-0.39	-2.87
1986	163.30	67.17%	0.53	16.87	0.14	1.96	0.28	0.67	18.92	0.00	-0.41	-2.88
1987	171.59	30.53%	0.34	17.56	-0.04	2.02	0.46	0.34	19.75	-0.04	-0.47	-2.89
1988	149.48	9.94%	0.34	17.41	-0.24	1.88	-1.36	0.34	19.58	-0.24	-0.74	-4.98
1989	218.08	110.26%	1.38	20.30	0.45	2.42	2.35	1.83	22.99	0.00	-0.77	-1.38
1990	213.10	25.41%	1.31	20.59	-0.15	2.38	1.73	1.70	23.51	-0.18	-0.99	-2.45
1991	279.43	30.25%	1.48	23.67	-0.08	2.43	4.96	2.00	26.58	-0.09	-1.13	1.29
1992	489.62	33.52%	1.45	34.15	-0.02	2.53	14.32	1.96	31.77	-0.02	-1.21	17.86
1993	620.42	422.04%	3.73	41.33	2.28	4.94	19.54	2.03	34.46	3.99	2.72	28.69
1994	333.48	122.69%	1.97	28.47	0.62	5.81	6.78	3.06	31.71	0.00	2.85	3.63
1995	354.27	129.49%	1.89	29.95	0.64	6.74	7.42	2.80	34.02	0.07	3.07	3.49
1996	315.30	93.08%	1.56	29.21	0.39	7.47	5.13	2.23	33.80	0.00	3.22	0.07
1997	401.20	133.82%	1.56	33.05	0.59	8.43	8.99	2.03	38.53	0.11	3.50	3.86
1998	379.94	154.18%	1.71	33.06	0.70	9.56	7.61	2.03	39.20	0.39	4.06	1.30
1999	621.12	184.82%	4.21	42.90	1.57	11.60	18.01	5.37	48.94	1.68	5.95	14.90



Table A.5 The funds' returns on investments in shares and contracts and their standard deviations

Contract period (years)	<b>10</b>	<b>5</b>	<b>1</b>
Average annual market return	14.66%	13.05%	12.54%
Standard deviation of annual returns	37.33%	34.62%	35.54%
<b>Waiver contract</b>			
Rate of waiver required	43.79%	56.08%	77.36%
Funds' return on investment in shares and contract	8.28%	7.45%	7.22%
Standard deviation of funds' return on investment in shares and contract	21.03%	14.64%	5.60%
<b>Collar contract</b>			
Ceiling rate	8.46%	8.12%	7.66%
Funds' return on investment in shares and contract	7.33%	6.19%	5.59%
Standard deviation of funds' return on investment in shares and contract	12.38%	7.41%	2.20%

**Assumptions: s.d. = 20% , r = 5% , floor = 3%**

Diagram A0: The general stock price index, adjusted for gross dividends and Israeli stocks in New York (1994 - 1999)

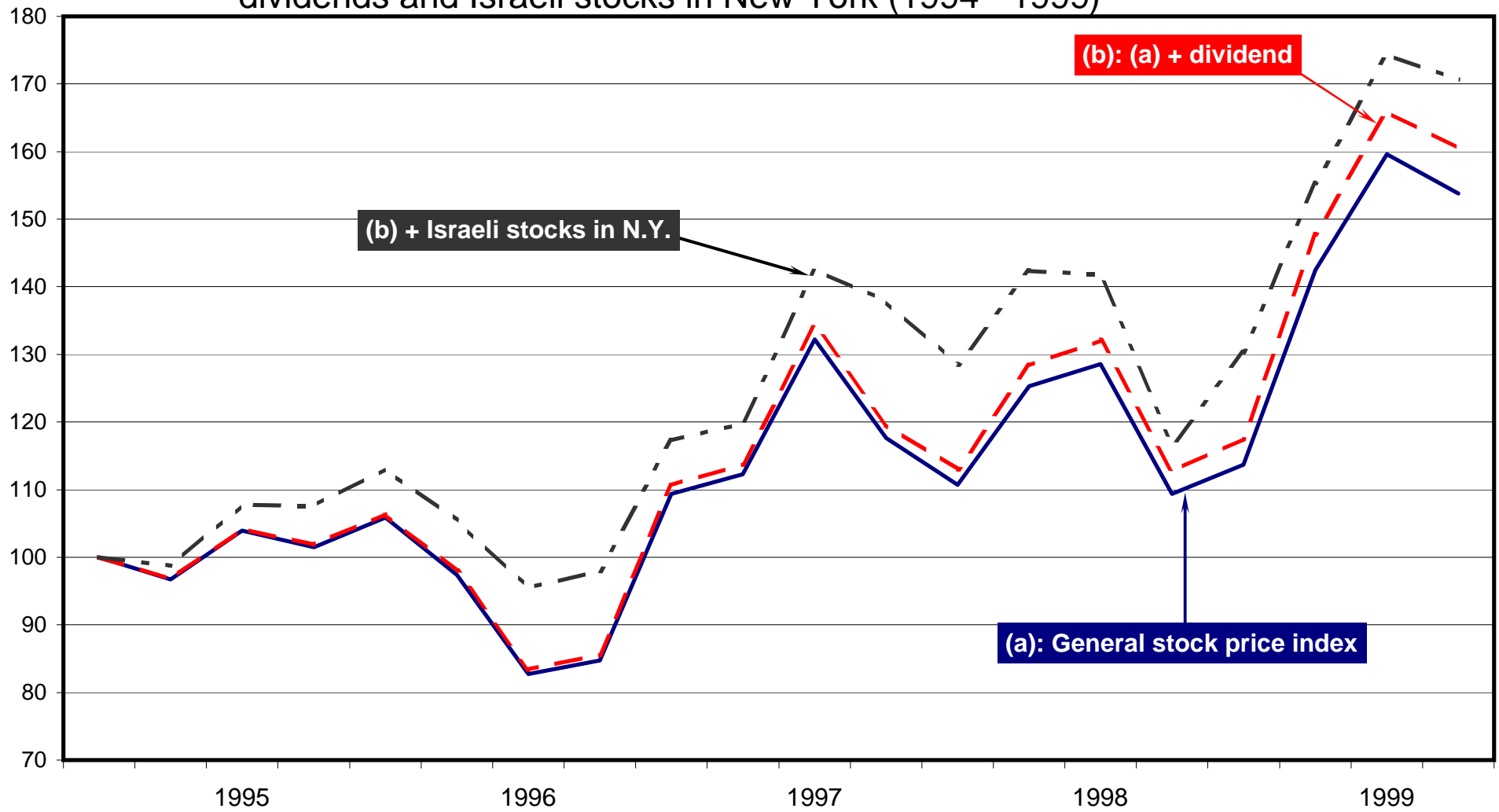


Diagram A1.1a: Insurer's annual cash flow and state of fund related to the issue of waiver contracts for NIS 1 for one year.

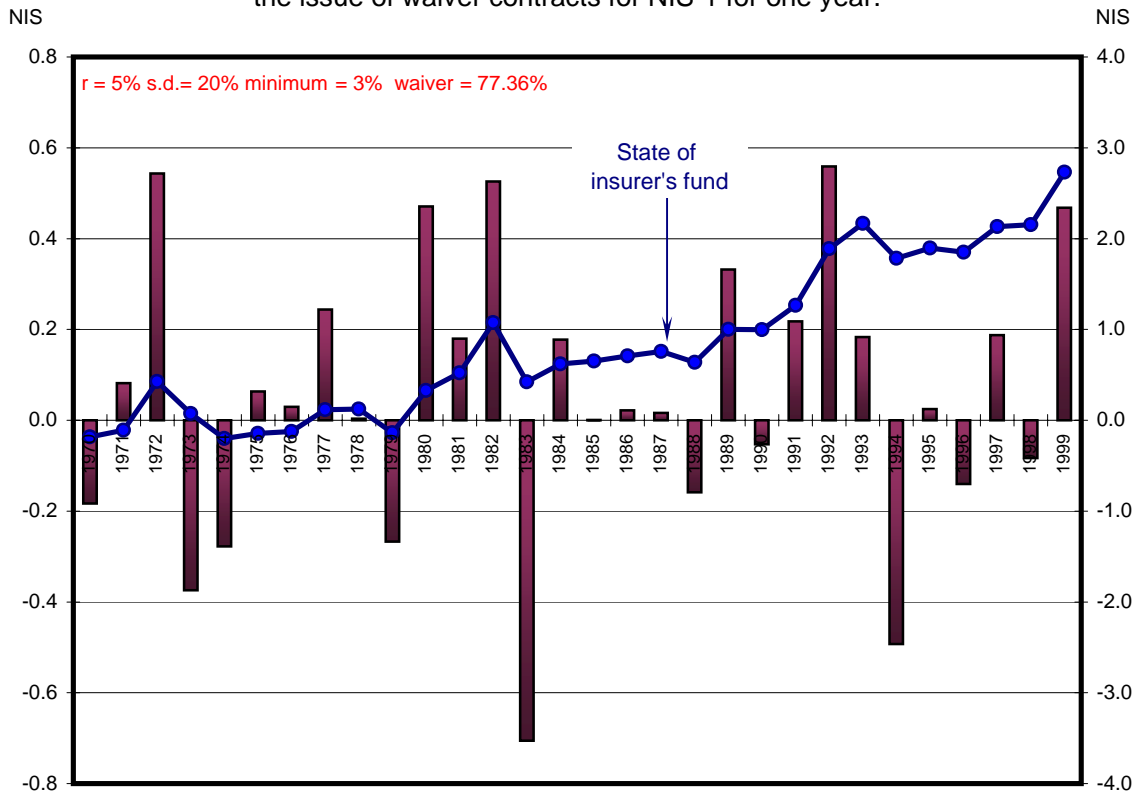


Diagram A1.1b: The funds' receipts from investing NIS 1 for one year in shares and in waiver contract

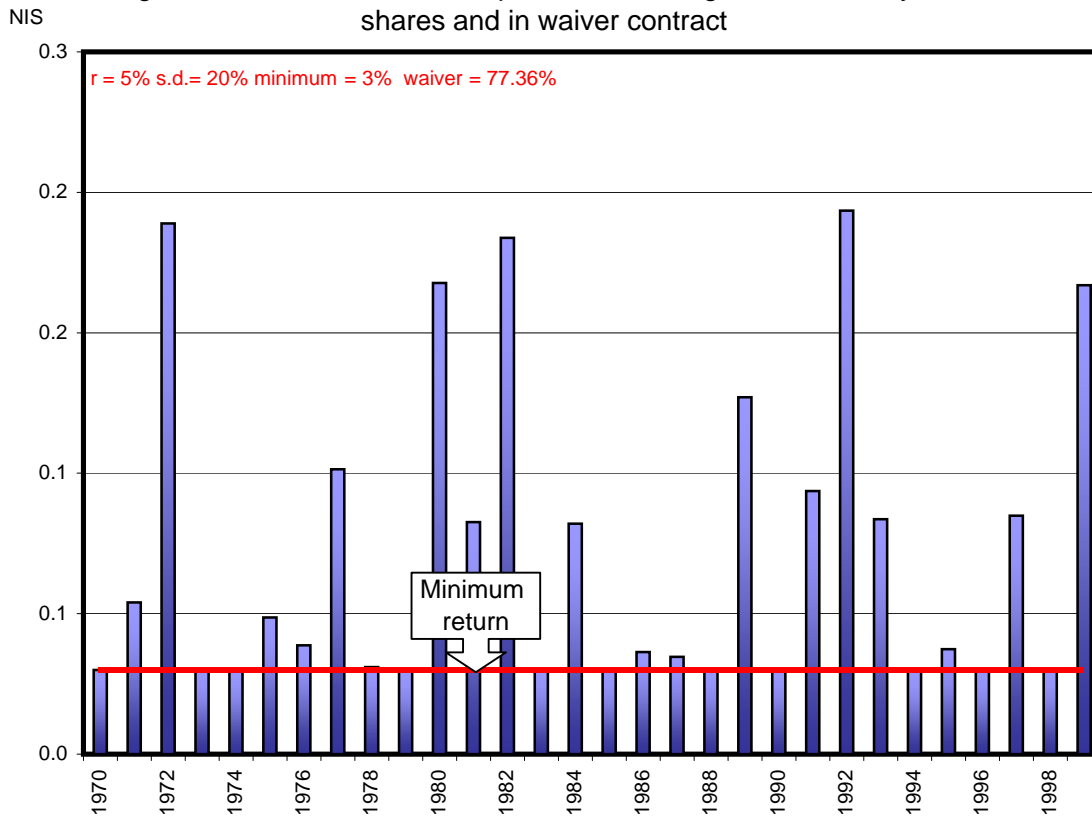


Diagram A1.2a: Insurer's annual cash flow and state of fund related to the issue of collar contracts for NIS 1 for one year.

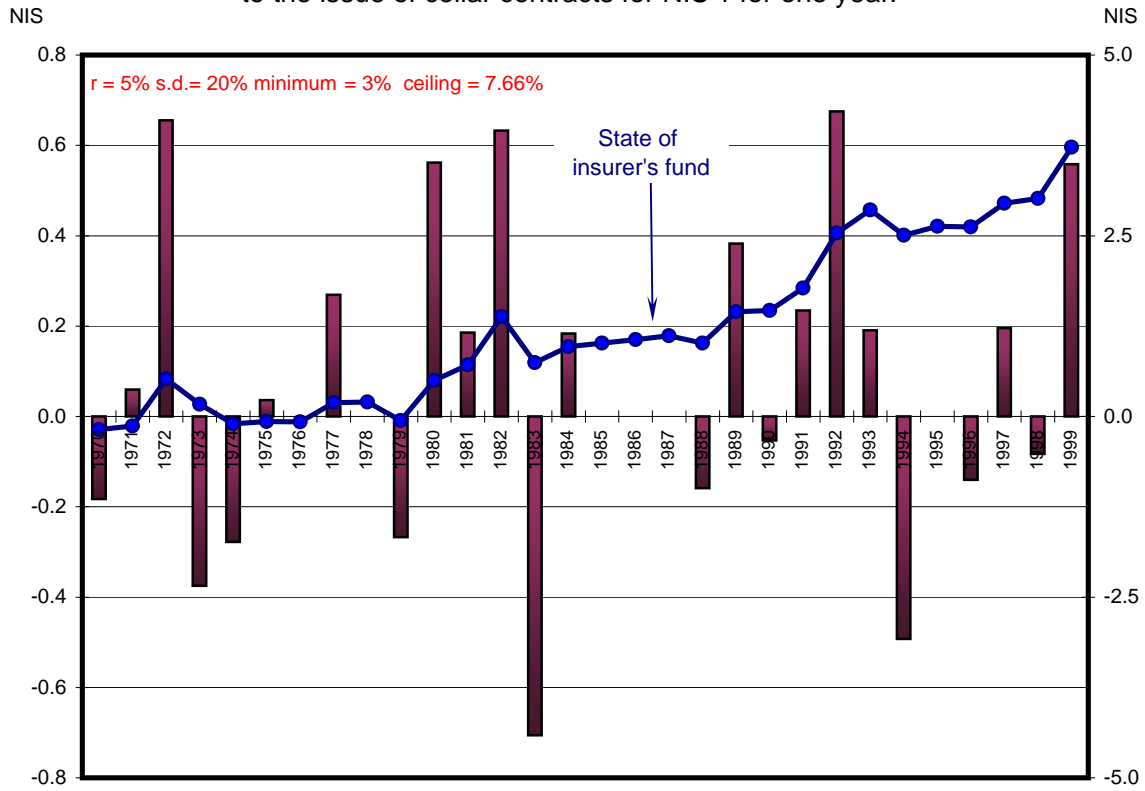
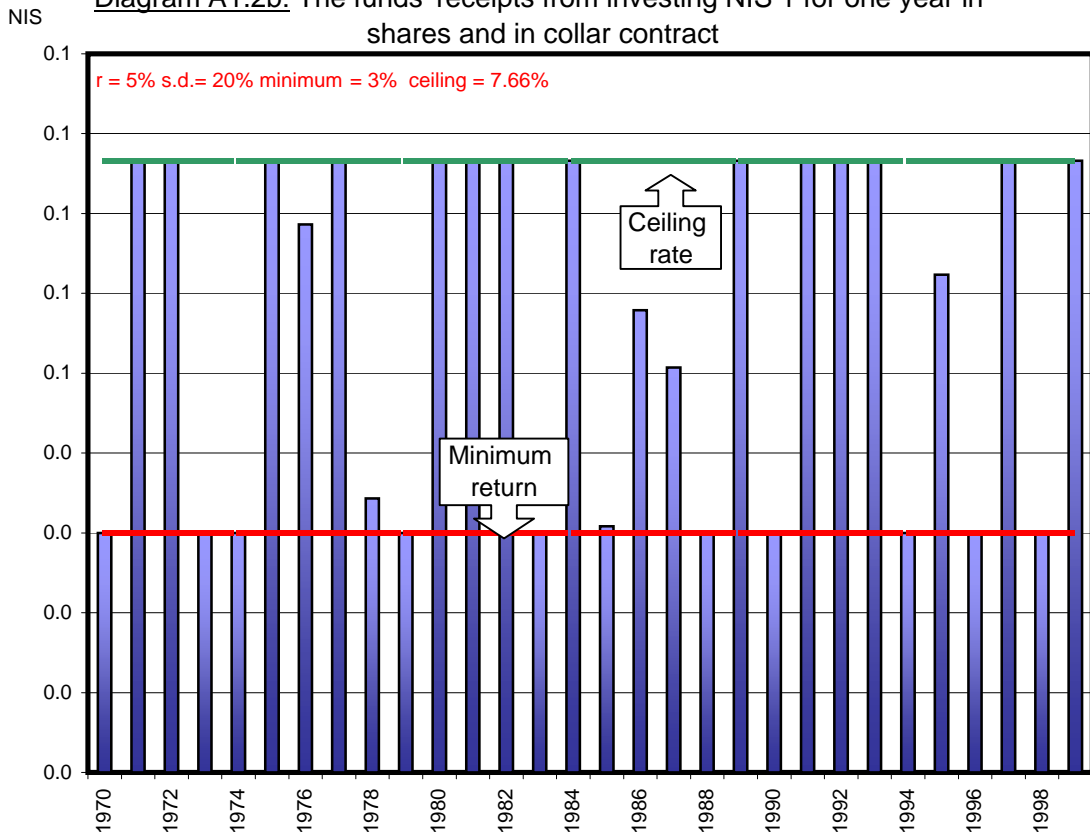
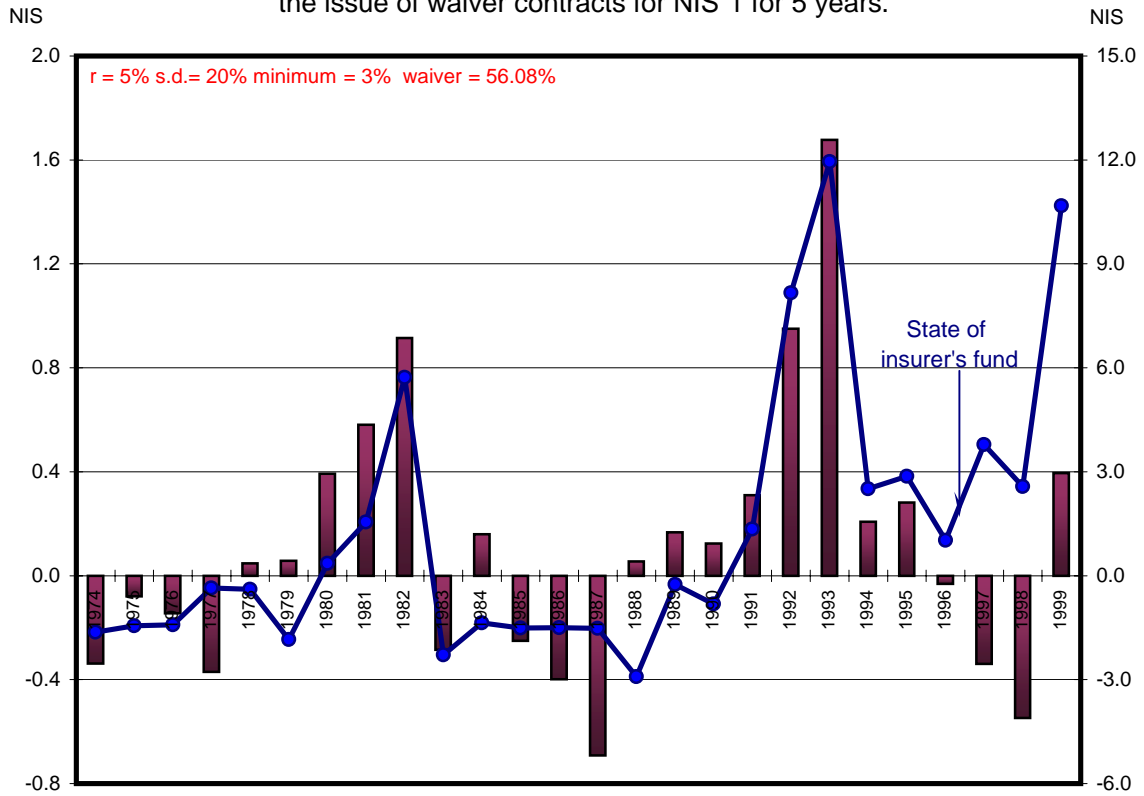


Diagram A1.2b: The funds' receipts from investing NIS 1 for one year in shares and in collar contract



**Diagram A2.1a:** Insurer's annual cash flow and state of fund related to the issue of waiver contracts for NIS 1 for 5 years.



**Diagram A2.1b:** The funds' receipts from investing NIS 1 for 5 years in shares and in waiver contract

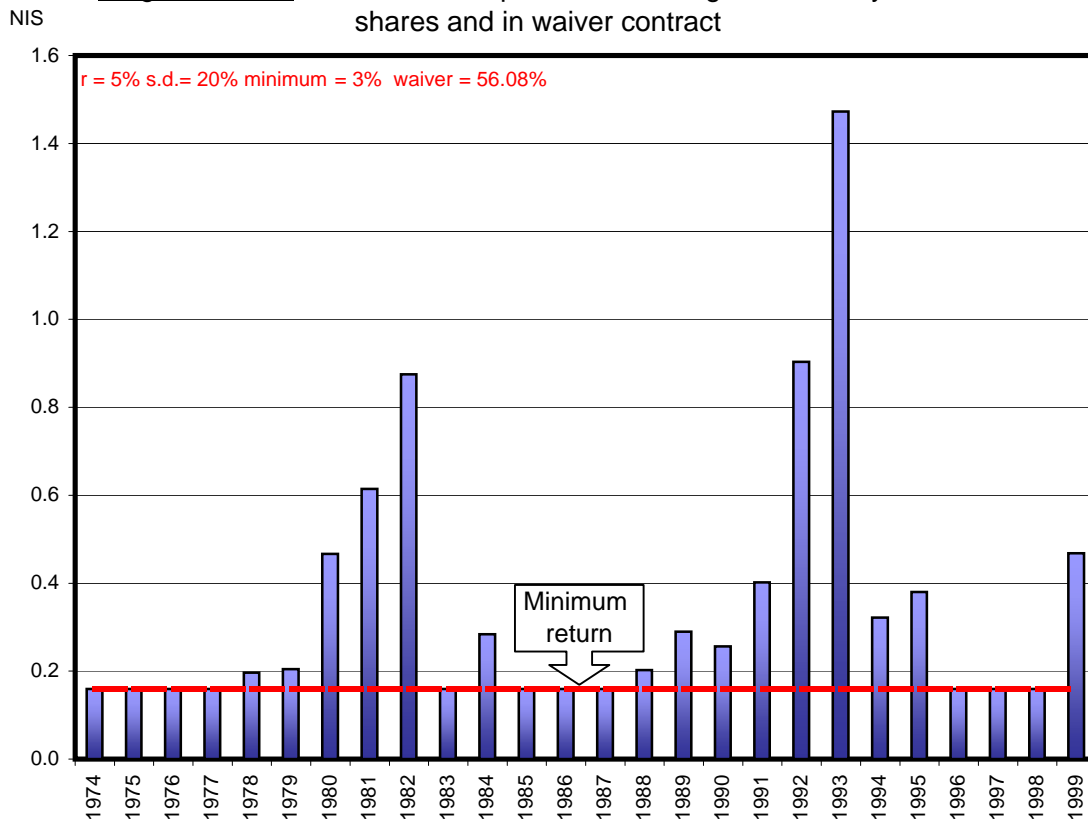


Diagram A2.2a: Insurer's annual cash flow and state of fund related to the issue of collar contracts for NIS 1 for 5 years.

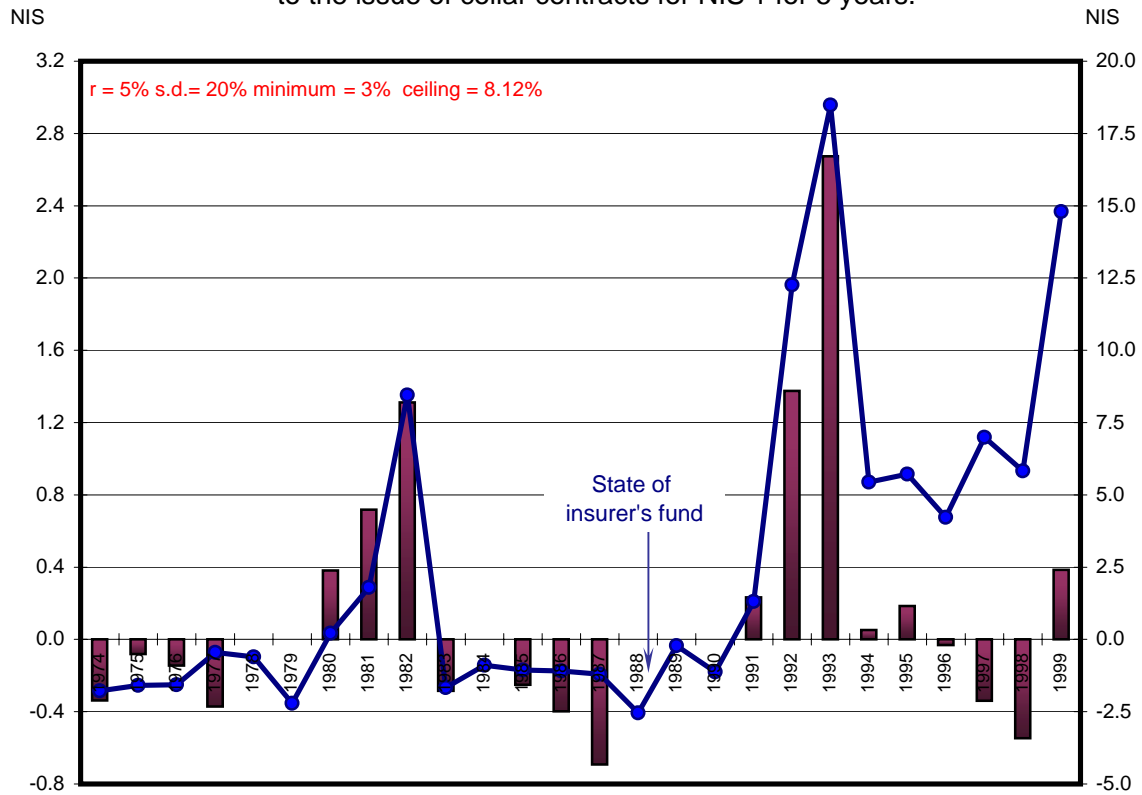
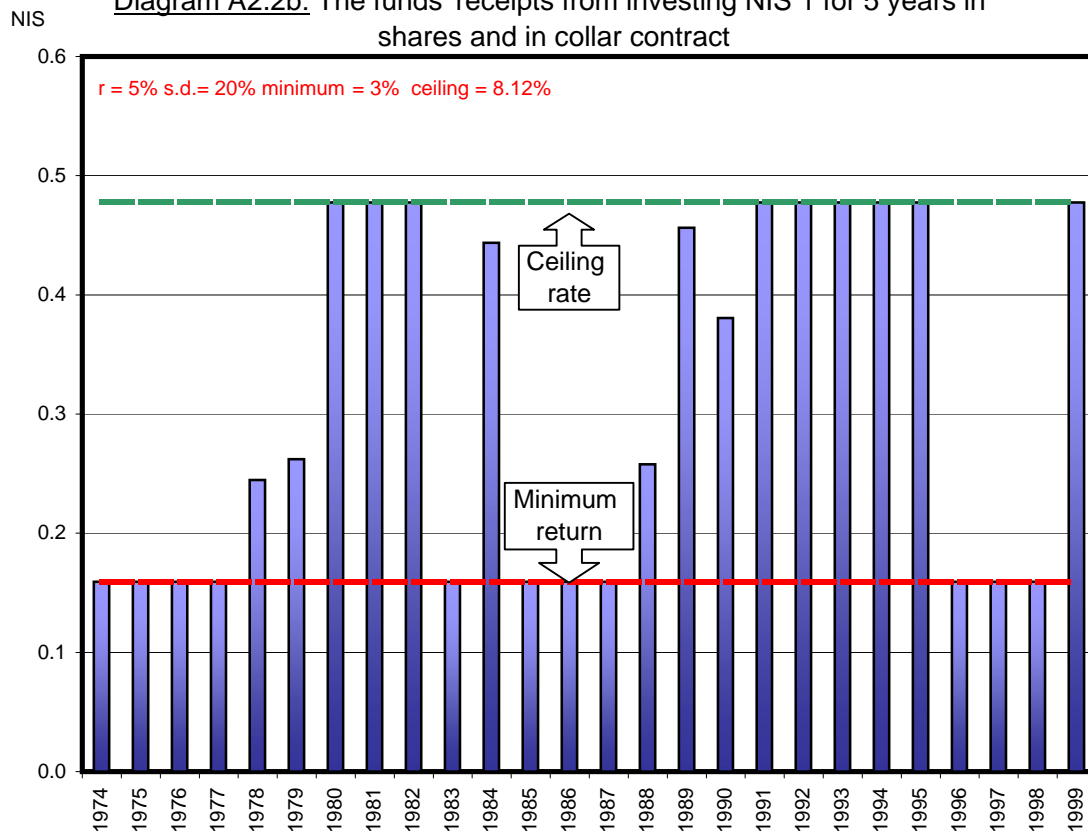
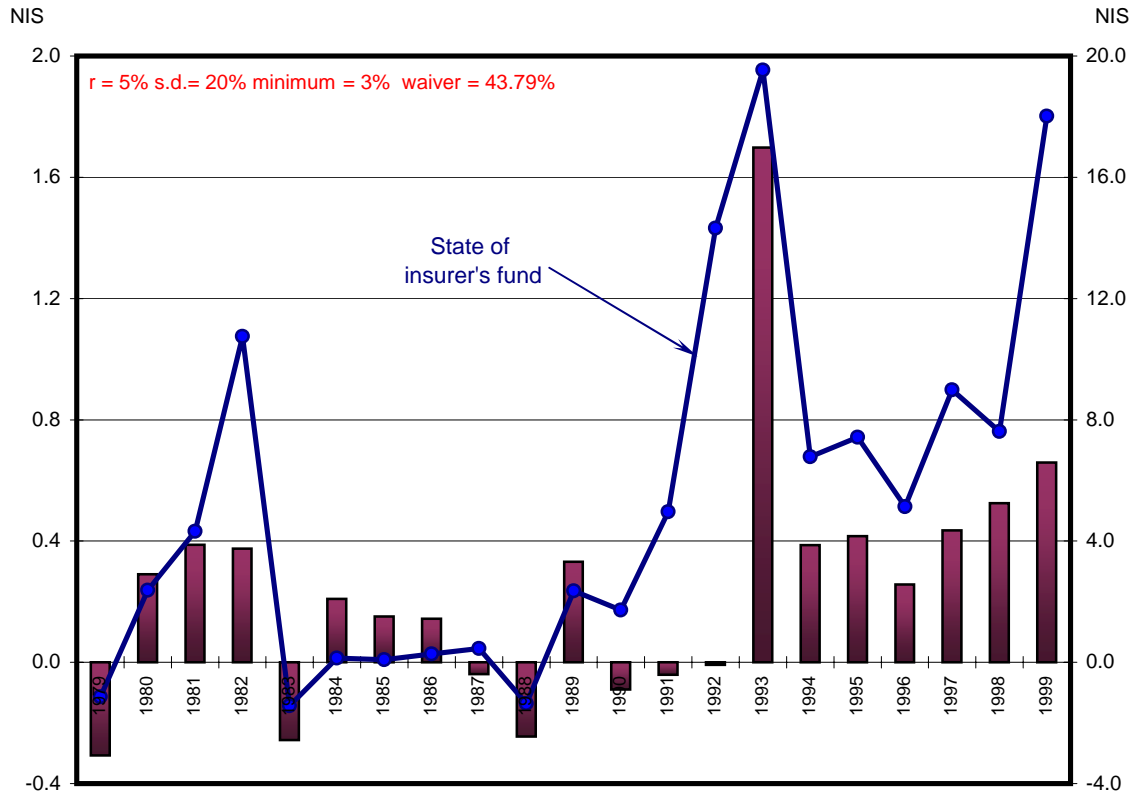


Diagram A2.2b: The funds' receipts from investing NIS 1 for 5 years in shares and in collar contract



**Diagram A3.1a:** Insurer's annual cash flow and state of fund related to the issue of waiver contracts for NIS 1 for 10 years.



**Diagram A3.1b:** The funds' receipts from investing NIS 1 for 10 years in shares and in waiver contract

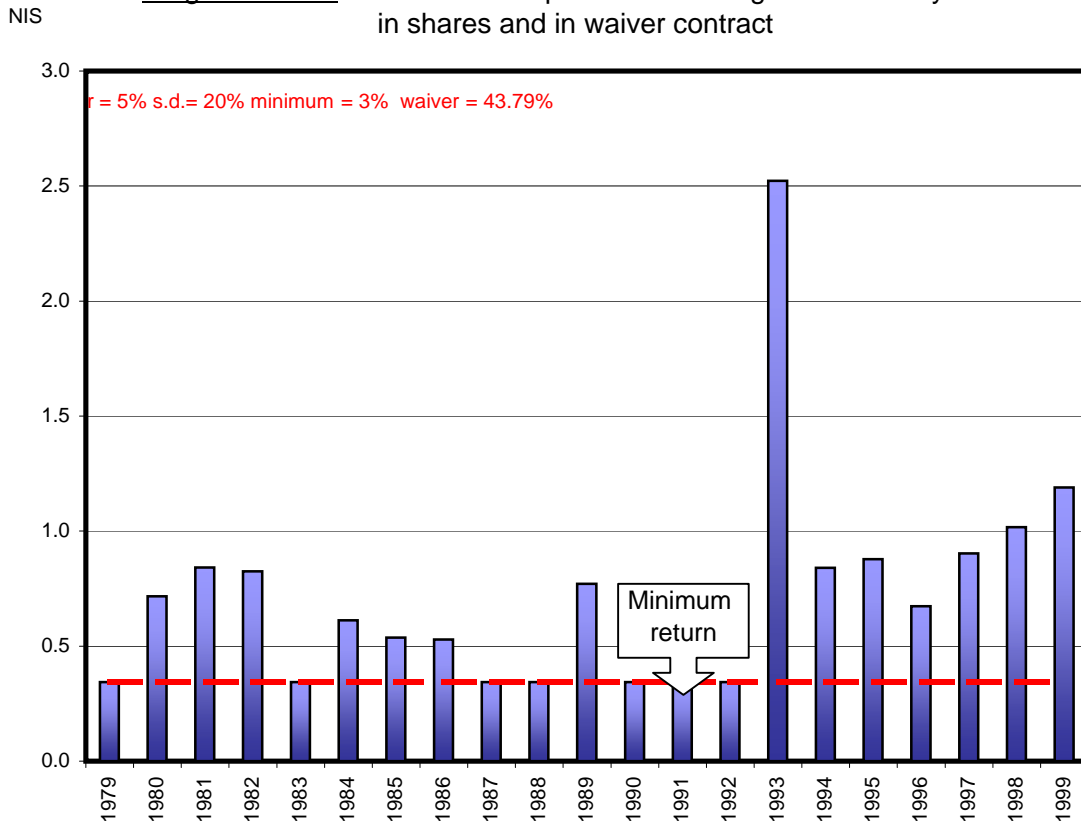


Diagram A3.2a: Insurer's annual cash flow and state of fund related to the issue of collar contracts for NIS 1 for 10 years.

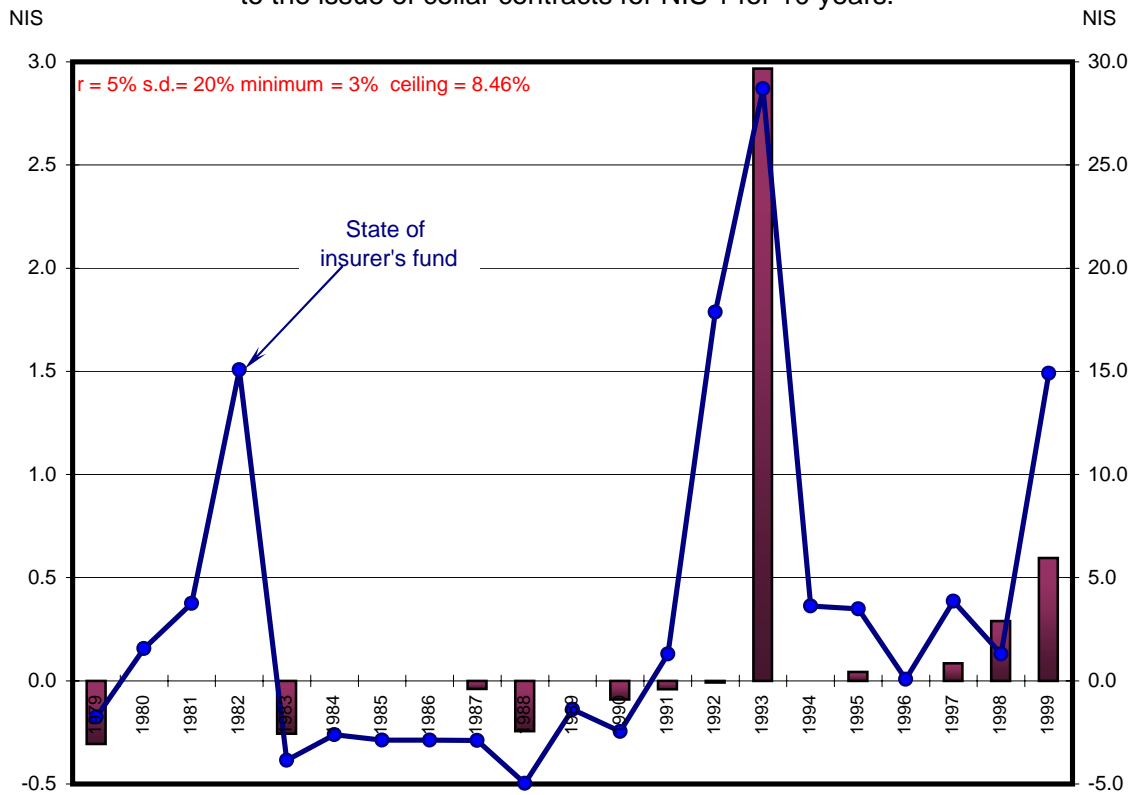


Diagram A3.2b: The funds' receipts from investing NIS 1 for 10 years in shares and in collar contract

