V. Market-based Inflationary Expectations as an Indicator for Monetary Policy: The Case of Israel

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The object of this study is to estimate the public's inflationary expectations for the period 1988–98, by means of prices of CPI-indexed (Consumer Price Index) and unindexed bonds. The financial markets in Israel enable inflationary expectations and expected real interest rates to be derived for periods up to one year without making strong assumptions. In the model described, it is assumed that in this time scale there is no risk premium, and hence neither the trend of expectations, nor their level, is biased significantly. Inflationary expectations serve as an important indicator in determining monetary policy, even more so in recent years when policy has been based on setting inflation targets.

In general, inflation expectations were reasonably close to actual past inflation developments. Initially, the announcement of inflation targets led to a certain reduction of expectations, but thereafter the announcements did not themselves have any real affect on inflation expectations until significant policy measures were instituted to curb inflation. The contractionary monetary policy adopted toward the end of 1994 and toward the end of 1998 in the wake of the surges in inflation reversed the trend of inflationary expectations indicating that the public accorded credibility to the policy-makers' determination to fight inflation.

A. Introduction

Inflationary expectations are vital for understanding the public's behavior in the money, capital, and nonfinancial markets; they also play a major role in the determination of monetary policy. This paper sets out to estimate inflationary expectations by means of the prices of indexed and unindexed bonds, since they help to explain the public's behavior and Israel's monetary policy. This applies particularly to the last few years, when this policy was based on an inflation target. The gap between inflationary expectations and the announced inflation target can serve as a guide regarding monetary policy required to achieve the target. The reaction of inflationary expectations to monetary and/or fiscal measures may indicate the credibility with which the measures are perceived. In a number of industrialized countries the use of variables of expectations—derived from the behavior of the financial markets—as indicators of appropriate monetary policy has become widespread.

The estimate of inflationary expectations is derived from market prices of securities, and this is the source of its robustness. It could be obtained by polling the general public or relevant

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groups. Such an estimate, however, which bears no penalty for error, cannot be compared to one that is employed, after due consideration, in buying or selling indexed and unindexed assets, when a mistaken estimate can cause considerable loss. Banks, institutional investors, and the general public make great efforts to estimate the Consumer Price Index (CPI) in order to trade in securities and treasury bills, hence information derived from market prices should constitute a reliable indicator of inflationary expectations. Another advantage of market prices is that they reflect a weighted average of these expectations, and under conditions which will be specified below, price differences between indexed and unindexed securities reflect, mainly, inflationary expectations.

Unlike earlier assessments of inflationary expectations, which assumed the real interest (Yariv, 1990), or which were based on expectations for a period of one month only (Yariv, 1993), this chapter deals with estimates of expectations for periods of between one month and a year. In the process of estimation, both inflationary expectations and real interest rates are obtained simultaneously.

The development in recent years of trading markets for unindexed securities for periods of up to a year, together with the existence of trade in indexed bonds for the same length of time, enables inflationary expectations to be derived without making any assumptions about real interest, a fact which makes the estimates more robust. An analysis of the results shows that inflation expectations were quite close to actual past inflation developments. Sometimes, however, actual inflation differed from that expected for a given period; notable instances of this were the unexpected downward movements in 1992 and 1998, and the unexpected rise in inflation in 1994. Nevertheless, in the last few years the public has become more aware of the effect of monetary policy on inflation. For example, in 1998, following the rise in inflation expectations in the wake of the increase in the exchange rate, expectations fell again after the increase in the Bank of Israel interest rate.

The announcement of an inflation-rate target at the end of 1991 helped to reduce inflationary expectations at that time, but the announcements of the targets for 1993–95 did not give rise to any significant change in expectations. It seems that the announcement of a target initially contributed to the reduction of inflationary expectations and the confirmation of trends evident at that time; thereafter, only announcements that were accompanied by significant policy measures encouraged stability and reduced expectations.

Several estimates of inflationary expectations used in various countries based on indexed securities are described in the second section. The third section describes the model and the derivation of the estimates, and formulates the assumptions required to obtain numerical results. The fourth section discusses the significance of the various assumptions, particularly those regarding the tax factor and the risk premium. The final section presents the main findings regarding the development of inflationary expectations in 1988–98, concentrating on those periods in which there was a significant difference between the paths of actual and expected inflation. The policy of inflation targets, its announcement, and the market reaction to it, are discussed separately below.

B. Inflationary Expectations and Indexed Bond Markets

Many studies have tried to estimate inflationary expectations. This paper uses the existence of markets for indexed and unindexed securities in Israel for this purpose. Although indexed markets develop in countries with persistently high inflation, the functioning of the unindexed capital market is impaired, making it difficult to derive expectations. Countries with low inflation usually have only an unindexed capital market, on the basis of which attempts are sometimes made to derive inflationary expectations. These involve making relatively strong assumptions about real interest rates and the risk premium.

Pioneering studies have been carried out in Israel by Cukierman (1973), but at that time the empirical results were meager due to the absence of a significant unindexed market. In a study undertaken in the mid-1980s (Yariv, 1990), inflationary expectations during disinflationary economic programs were estimated by identifying the nominal component of indexed bond contracts. An estimate was obtained for 1984–87 that was appropriate for expectations during a relatively rapid rise in prices, since it was based on indexation loss close to the date of maturity, which increases when inflation rises. The latter study requires that an assumption be made regarding the real rate of interest, but for a period of high inflation this does not adversely affect the quality of the estimates. Note that as a result of the acceleration in inflation, the extent of unindexed contracts fell steeply, and expectations were estimated by a method appropriate only to the Israeli bond market.

The decline in inflation in Israel and the development of trading markets for unindexed bonds of up to one year to maturity currently makes it possible to derive inflationary expectations for longer periods. The present paper gives estimates for 3, 6, 9, and 12 months by extending the study of one-month inflationary expectations (Yariv, 1993). The reader will see that the estimates are particularly robust as no assumptions need to be made concerning real interest rates. Moreover, the fact that there are two markets enables inflationary expectations and real interest rates to be derived simultaneously.

England began developing the market for indexed bonds in 1982, and inflation expectations were estimated both for purposes of empirical research and by the Bank of England, which used inflation expectations as an important monetary indicator (see Deacon and Derby, 1994, and the Bank of England Inflation Reports). There is a problem in estimating expectations in England due to the indexation lag, which can be as long as eight months. This issue is dealt with by using a dynamic model which assumes the same rate of inflation—also for a period in which there is no compensation for price increases. Another difficulty arises from the relative paucity of series of indexed bond; this is tackled by calculating the yield curves of nominal and real returns and simultaneously deriving the inflation expectation curve.

After more than ten years of discussions and preparatory work by the U.S. Treasury and the Federal Reserve, indexed bonds were first launched in the United States at the beginning of 1997, for periods of five, ten, and thirty years. One of the objectives was to provide estimates of inflation expectations and of real interest from the capital market. Due to liquidity problems in the developing market for indexed bonds, and particularly compared with the

high liquidity in the conventional bonds market, the spreads of real and nominal returns reflected the liquidity premiums that the market required from the indexed market, as well as inflation expectations. For the time being, this greatly limits the use of estimates of both inflation expectations and real interest (this factor is added to the risk premium component, which, for long periods, is not insignificant). It is reasonable to expect that as the market develops with proper attention being paid to the risk premium, the use of these estimates in economic analysis and in the formulation of monetary policy will increase. In Canada, a number of indexed bonds were issued at the beginning of the decade, although it is uncertain whether this practice should continue in the light of the negative implications for the battle against inflation.

C. The Model

The model is based on Fisher's equation in which expected inflation is (approximately) equal to the difference between nominal and real interest rates. The former is obtained from the unindexed bond market, and the latter from the indexed bond market. The existence of these two distinct markets for parallel periods of up to one year makes it possible to derive inflationary expectations and their yield curves (as well as their respective real interest rates).

Note that in estimating expectations there is an underlying assumption that the two markets are comparable (i.e., that the difference between them is due mainly to inflationary expectations) and that other factors are either irrelevant or constant over time, and may therefore be ignored. The significance of these assumptions is discussed below.

The method of deriving expectations is as follows. If indexation were implemented daily and there were no lag in the publication of the inflation rate, inflationary expectations could be derived according to the customary formula, with real interest being obtained from a simple calculation of real yield to maturity. However, this is not the case.

In order to calculate the real yield to maturity of bonds, three distinct periods in the life of a bond regarding indexation differences must be considered. They are represented by the following:

a – the period when price increases for the previous month have occurred but have not yet been published (when expectations are calculated);

b – the period in which the bond provides full compensation for inflation; and

c – the period close to maturity of the indexed bond when inflation is not compensated for.

The nominal yield of a bond over *n* months is defined as the sum of the expected nominal receipts to maturity relative to the market price of the bond.

To obtain the real yield of that bond, the indexation differentials which will be accrued must be imputed to the nominal receipts, while price increases up to its maturity must be deducted.

The following are used:

r_j – real interest to the appropriate time (j = a, b, c).
n – the number of months fully compensated by the indexed bond.
A_n – the known nominal indexation differentials accrued on indexed bonds.
R – the final coupon to be received on maturity (after tax).
B_n – the market price of a bond appropriate for measuring price increases over n months.
EP_j – expectations of the increase in prices to time j ($j = a, b, c$).

The real yield[2] of the bond from the date of measurement until maturity may be represented as follows:

$$(1 + r_{(b+c)}) = \frac{A_n(1+R)(1+EP_a)(1+EP_b)}{B_n(1+EP_b)(1+EP_c)} \qquad (1)$$

By simplifying equation (1), the real yield for the period of estimating inflation (b) can be shown as:

$$(1 + r_b) = \frac{A_n(1+R)(1+EP_a)}{B_n(1+EP_c)(1+r_c)} \qquad (2)$$

As stated above, expected inflation is defined as nominal interest, derived from the Treasury bill market, (i_b), *divided by* real interest as shown in equation (2).

$$(1 + \mathrm{EP_b}) = \frac{(1+\mathrm{i_b})}{(1+\mathrm{r_b})} \qquad (3)$$

Substituting equation (2) in (3), we obtain

$$(1 + EP_b) = (1 + i_b)\frac{B_n}{A_n(1+R)}.\frac{(1+EP_c)(1+r_c)}{(1+EP_a)} \qquad (4)$$

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[2] The real yield of a bond is actually the real yield corrected for two factors: ($(1 + EP_a)$, the current, as yet unpublished, increase in prices, and $(1 + EP_c)$, the increase in price on maturity, for which there is no compensation. Note that bond traders may assess these variables differently.

Multiplying real interest by the nominal factor in the period close to maturity gives nominal interest for that period. We assume that the required nominal yield in that period is the same in both markets, and hence equation (4) can be shown as:

$$(1+EP_b)=(1+i_{(b+c)})\frac{B_n}{A_n(1+R)}\cdot\frac{1}{(1+EP_a)} \qquad (5)$$

All the variables on the right side of the equation are known from the market, except for the last rate of increase in prices which has occurred but has not yet been published. Expectations regarding the CPI may be derived in a similar manner by the use of two bonds, one indexed and the other unindexed, with just one more index increment, EP_a due to accrue to the indexed bond (Yariv, 1993).

In other words,

$$(1+EP_a)=(1+i)\frac{B_1}{A_1(1+R)} \qquad (6)$$

where *i* is the yield on a treasury bill for the same period as the bond due to one more monthly index increment.
Real interest is obtained by using the nominal yield in the treasury bill market and expected inflation derived from equation (5), and subsequently putting these in (3). This real interest is clearly the real yield required in each market.

E. Main Assumptions

Several assumptions which must be made in order to obtain numerical results are discussed below, and an attempt is made to assess their effect on the quality of the estimates. They relate to general principles of taxation affecting market participants, the risk premium required by the market because of uncertainty regarding inflation, and substitutability of the markets.

Taxation

Taxation affects the expected return in both the indexed and the unindexed market, so that it warrants careful attention in order to identify the main players in the market—specifically, what is their tax status. Income on treasury bills is tax-free; therefore, the tax status is irrelevant. Investors in indexed bonds, however, break down into three types: those liable to tax on the coupon regardless of the holding period (gross return); those such as provident funds taxed relative to the holding period till the next coupon payment (relative gross return); and investors, mainly individuals and mutual funds, liable to a limited and final tax rate of 35 percent on the coupon (net return). The problem of taxation and its effects on inflation

expectations is not peculiar to Israel; in England, for example, two estimates of inflation expectations are published based on different assumptions regarding tax rates and the market's reaction to them.

Holdings of indexed bonds in Israel have also changed significantly. Until the beginning of the 1990s, mutual funds were the main investors in the market; this was particularly marked regarding their share in trading (especially in the short term relevant to our estimations). In the last few years, it is the investment of the provident funds that are the most notable, accounting for more than 50 percent of the holding of indexed bonds in the market, although they do not always undertake large-scale trading in these bonds.

In the past, the real return was taken to be determined by net return (and an earlier version of this paper was published which followed that line). Since the mid-1990s, the basis of the estimate changes, and the estimate of real return refers to the relative gross return. Bond coupons go up to 4.75 percent, and the tax rate is 35 percent, so that the gap between gross and net expectations for a year can reach 1.7 percent. The trends of the two estimates will be similar—the difference between them being reflected by the level of inflation expectations and the level of expected real interest. In estimates of inflation expectations with a one-year horizon, which serve as an indicator for monetary policy, the gross return and the relative gross return are quite close to each other, so that this assumption does not create a substantial difference between the revised estimate and that based on the gross return.

Risk premium

It is assumed that the risk premium is constant and equal to zero, i.e., the public does not demand compensation for holding nominal assets exposed to the uncertainty arising from future inflation of an unknown rate. Ficsher (1984) and others have shown that when uncertainty regarding inflation prevails, nominal interest rates incorporate a risk premium for inflation.

It may be claimed that the absence of a specific reference to risk premium creates an upward bias in estimated expectations. Although in the theoretical consumption model the sign of the premium is not known at the outset, it is reasonable to assume that in Israel, where there is considerable uncertainty regarding inflation, the premium would be positive.

It is difficult to assess the extent of changes in the risk premium in the period reviewed, and this subject warrants separate study. It is reasonable to assume that the downward inflation trend, its volatility, and that of the exchange rate affected the changes in the size of the risk premium. In this context, the following points are relevant:

- As far as monetary policy is concerned, even if the rise in estimated expectations is based on an increase in the risk premium, the policy measures required are similar to those needed in the event of a rise in actual expectations. Hence, identifying changes in the risk premium may help monetary analysis, but is not essential for preventing bias.

- Regarding the actual level of expectations, the estimates obtained from the model are not significantly different from alternative estimates derived from CPI-indexed options contracts offered by some banks (See Fiszman,1995). It may be inferred from this assumption that the absolute level of the risk premium is not high, and apparently was relatively stable in the period under review, (expect perhaps during the end of 1998) and hence it is unlikely that the trends of inflationary expectations are biased.

- It is not certain that the premium required by the market is positive for all periods of expectations. Most short-term contracts are probably nominal, so it is these that are definite, and in this case the risk premium required for indexed contracts is positive. In 1988–94 inflation ranged from 10 to 20 percent, and in this period, despite Israel's history of inflation, no positive premium may have been required in short-term contracts (say less than six months). Note that with regard to the risk premium in long-term nominal markets such as the US, in which bonds may be for as long as 30 years, the risk component is very high, and its weight may be equivalent to that of real interest or expected inflation.

- There is no generally agreed-upon risk-premium model, and even if there were, it would still be problematic to make a quantitative estimate.

Substitutability between markets

The following discussion on substitutability between markets focuses on the structural aspects of both markets regarding their participants, fees, and efficiency. Since 1987, treasury bills have been traded on the stock exchange, and the total amount held by the public has risen significantly in real terms, to about NIS 20 billion in 1998. The individual series are quite large, about NIS 2.0 billion. The existence of series with similar periods to maturity, differing by between one week and one month, increases tradability. Although fees paid by the public are generally lower (0.1 percent at maturity) than those in the indexed bond market (0.2–0.5 percent). Members of the stock exchange, brokers, and mutual funds active in these markets pay considerably lower fees.

The total value of the bond market in 1998 was some NIS 90 billion; the value of one-year bonds varies, but sometimes reaches or even exceeds NIS 5 billion. Despite the considerable extent of the market, individual series are not highly tradable. Sometimes a particular bond series is not tradable, and its price fluctuates widely on a daily basis. The series with the highest market value were chosen, with a uniform coupon as far as possible. Due to the problem of liquidity of one single bond, two additional bonds whose maturities were within one month of that of the estimation horizon were included, reducing the estimated daily volatility (as a result of the paucity of series, with regard to expectations for a one-year horizon, bonds with maturity within two months of the estimation period have been included since the mid-1998).

The activity of mutual funds in the short-term bond and treasury bill markets at the beginning of the 1990s was noteworthy. Their level of sophistication is very high. With respect to arbitrage, it is sufficient for a few traders to treat these markets as highly substitutable for market prices to be used to estimate inflationary expectations.

Regarding the extent of substitutability between the markets, it is sometimes claimed that inflationary expectations cannot be derived from the treasury bill market when there are sharp fluctuations in the securities markets in general, and in the stock market in particular. It has been argued that extensive withdrawals from mutual funds result in a large supply of treasury bills, and the rise in yields is mistakenly interpreted in the model as higher inflationary expectations. This cannot be the case, however, because even if yields in the treasury bill market rise as a result of large withdrawals from mutual funds or sales in the stock market in general, the same phenomenon occurs in the short-term bond market, so that the real yield rises in both markets. In this case, there will be no change in estimated inflationary expectations, but real interest, or the required real yield, will rise, as in fact happens in the market when holders of securities attempt to sell.

A similar phenomenon occurs when a devaluation is expected. The existence of an alternative yield in the form of foreign-currency linkage raises the required yield in other markets. In this instance, yields rise in the treasury bill and short-term bond markets, but this does not necessarily lead to an increase in the derived estimates of inflationary expectations.

F. Analysis of the Findings

The operational assumptions of the model

Expectations from January 1988 to December 1998 were estimated.[3] Treasury bills and indexed bonds for up to one year have been traded since 1988. The estimates were compiled on each trading day, and the data presented are weekly or monthly averages based on daily observations (months being from the 16th of one month to the 15th of the following one). For example, from August 16 to September 15, daily expectations of annual inflation were estimated, relating to expected inflation over the next twelve CPI announcements (i.e., August of the subsequent year compared with August of the current one). The most appropriate bond for estimating annual inflation is the one that will benefit from the August index, maturing after the publication—on September 15—of the August CPI (i.e., maturing end-September). Note that the period under review is slightly more than a year (12.5 months on average). Therefore the yield on treasury bills was extrapolated for a longer period on the assumption that the slope of the yield curve for 9–12 months would also apply to a period of more than a year. For periods of less than one year there is no need to extrapolate the yield on treasury

[3] The calculations are all based on data published by the Tel-Aviv Stock Exchange (bond prices) and the Central Bureau of Statistics, Israel (CPI index).

bills, and series were chosen whose maturity dates were closest to that of the indexed bond. In the second half of the 1990s, as the slope of the curve flattened and even became negative, the return on one-year treasury bills was assumed also for longer periods.[4]

Between December 1993 and June 1994 there was no regular pattern of bonds maturing, so that for this period estimates of inflationary expectations could not be obtained for all periods. Estimates for relatively long periods—six months and longer—were obtained using series close to maturity, assuming, for example, that price increases over 11 months would be similar to the expected price rise in the 12th month; this procedure was adopted in order to obtain consistent series for the periods selected. When the gap between the period of the estimate and the one-year bond period was greater than three months, bonds of 13 and 14 months were used, assuming that the yield on treasury bills for that period would be an extension of the treasury bill curve. The validity of the data was checked by converging from a longer period and from a shorter period than the measured one, and similar estimates were obtained.

Inflationary expectations and expected real interest

Although inflationary expectations since 1989 have been basically the same as actual inflation, there have also been periods in which they differed considerably (Figure 1).[5] From 1989 until mid-1991, expected and actual inflation were markedly similar—between 15 and 20 percent. During 1992 the unexpected reduction in inflation was clearly reflected by the gap between expected (18–20 percent) and actual inflation (only 12 percent), the latter apparently associated with both the increased labor supply resulting from immigration from the former Soviet Union and the fall in housing prices and prices abroad. This is borne out by unindexed assets, whose proportion of the portfolio (except for shares) increased only in 1993, a development which may be expected at a time of a move to a lower inflationary environment.

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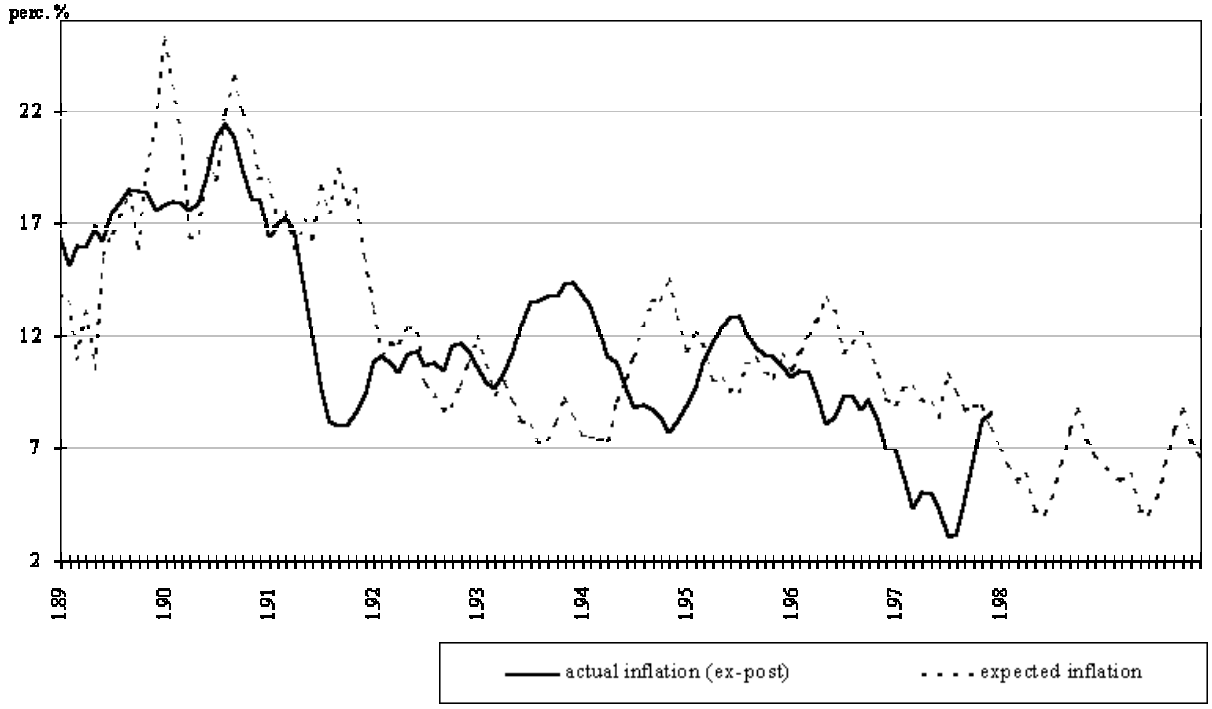
[4] On July 1, 1993, a shift was made in estimated inflation one month forward to series in which the coupon was 4.75 percent, and not 3 percent as hitherto. It was found that from then, estimates obtained under the assumption that the market consists of gross and net returns in equal measures are more reasonable. This assumption is made on additional economic grounds and on information provided by those active in the market. On July 1, 1997, the tradable redemption of bonds ceased, and the one-month estimate was calculated from the expected rate of inflation for the previous month, taking monthly seasonality into account. Since August 1998, the current index has been chosen according to the average of inflation forecasters' predictions, and the estimates from this source have been found to be quite accurate, and free of systematic bias.

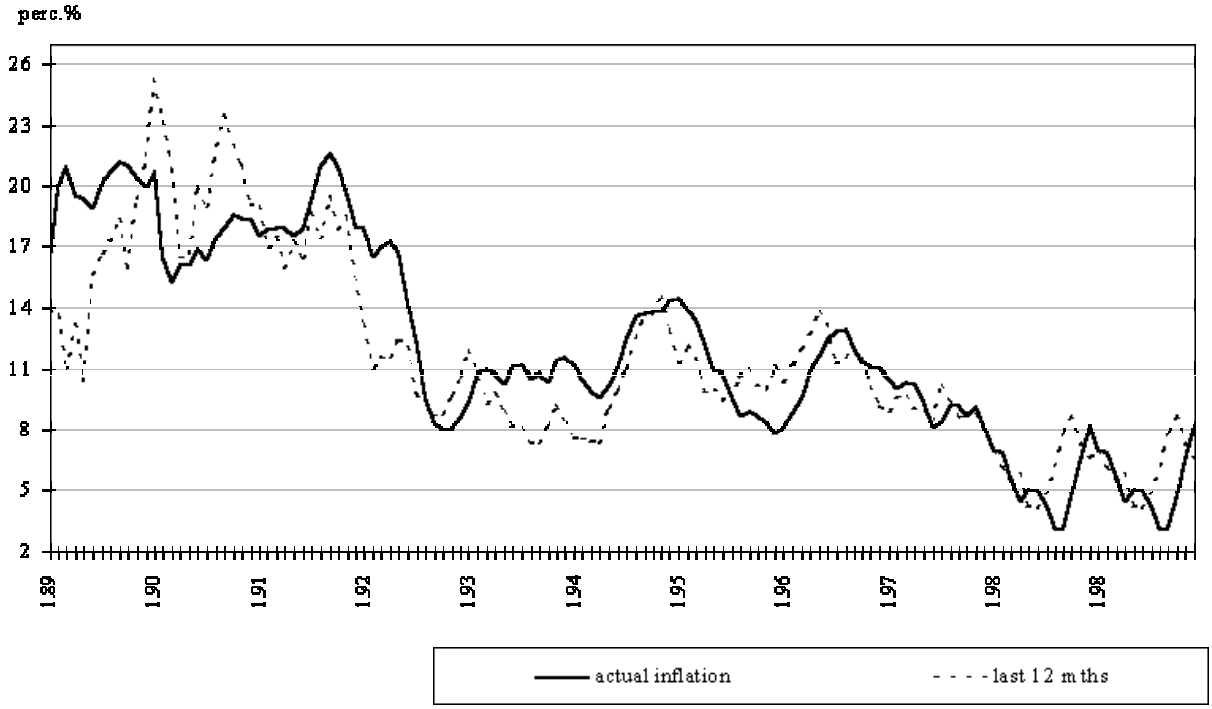
[5] 12-month expectations have been analyzed since 1989 because 12-month treasury bills were launched then, and expectations prior to that date had been based on shorter-term treasury bills.

Figure 1. Yearly Expected and Actual (Ex-Post) Inflation
(12 Months 1989–98)



Toward the end of 1993 and at the beginning of 1994 the gap between expected and actual inflation widened again. Expectations remained at the level of the previous year's inflation (10–11 percent), while actual inflation rose from 10–15 percent. There was another surprise in 1998, mainly in the first half of the year, when the public did not foresee the reduction in inflation that derived from the slowdown in economic activity and the reduction in world prices of raw materials. A closer examination of the correlation between inflation in the last twelve months and expectations is enlightening. It seems that the process of forming expectations is to a considerable extent adaptive (see Figure 2), as expectations are adjusted only after a new level of inflation has been experienced for a while. Only in exceptional circumstances (e.g., the 1985 economic stabilization program) was there a change that stemmed from declared policy measures rather than from the actual measures themselves.

Figure 2.
Inflationary Expectations and the Last 12 Month Inflation Rate
(1989–98)

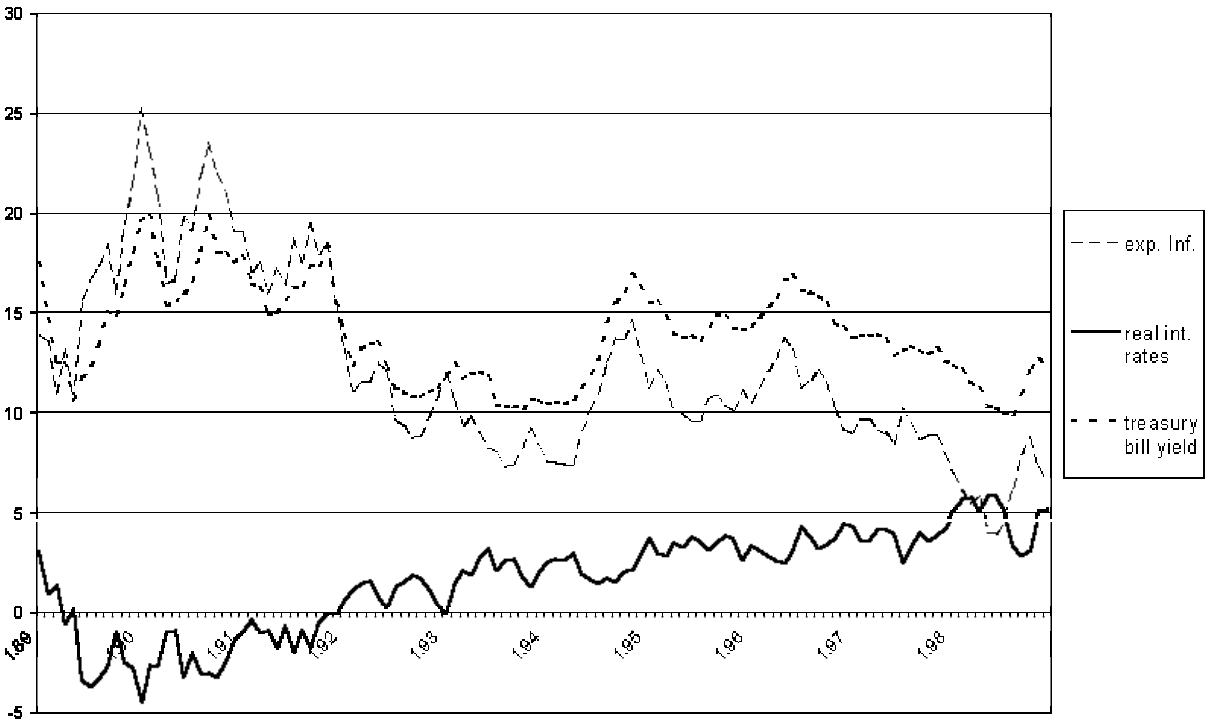


When a limited package deal was implemented late in 1984, a learning process also became evident. This arrangement involved an agreement between the employers, the government, and the unions to freeze (or to preset a slow change for) several controlled prices and wages. Inflationary expectations fell only after relatively low increases in the CPI had been published, confirming the success of the policy measures. The experience gained from the 1984 package deal assisted the adjustment of expectations when a broader stabilization program was implemented in mid-1985.

The identification of the causes of changes in nominal interest is of great relevance, and is closely linked with the implementation of monetary policy. Is the change perceived as a change in inflationary expectations or does it stem from changes in real interest? Fama (1975) examined this question, focusing on nominal interest as an indicator of inflationary expectations, and on the stability of real interest. A partial answer to this question is provided by Figure 3, which gives the yield on 12-month treasury bills, inflationary expectations and real interest over a given period, and shows that most of the changes in nominal interest arise from changes in inflationary expectations. Note that real interest for one year, as derived from the model, correlates closely with the trend of the yield to maturity of 3- and 10-year bonds.

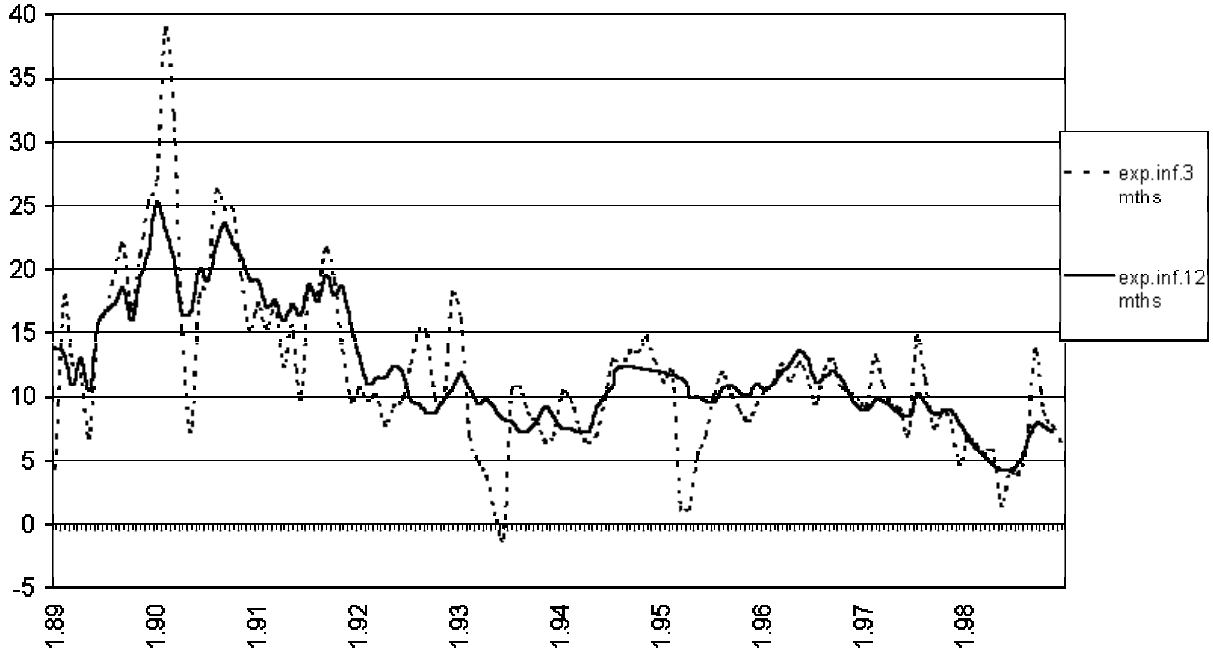
An analysis of expected real interest in the period under review shows that the level of real interest rates continued falling from 1989 to 1991 (Figure 3). This is connected with the reduction of interest from the high level prevailing after the stabilization program of 1985–87, and was achieved slowly, through the liberalization of the capital market among other considerations. In 1992–94 real interest on treasury bills stabilized close to zero, fluctuating by about one percent in each direction. Alongside the rise in nominal interest from about 10 percent at the end of 1993 to some 15.5 percent in September 1994, there was an increase in inflationary expectations, with no significant change in expected real interest rates. Only toward the end of the year was the rise in interest perceived as an increase in real interest, indicating a determined implementation of monetary policy. The rise in real interest continued in 1994–98, reflecting the tight monetary policy pursued by the Bank of Israel in that period in order to attain the inflation target.

Figure 3.
Expected Inflation, Treasury Bill Yields and Real Interest Rate
(12 Months)



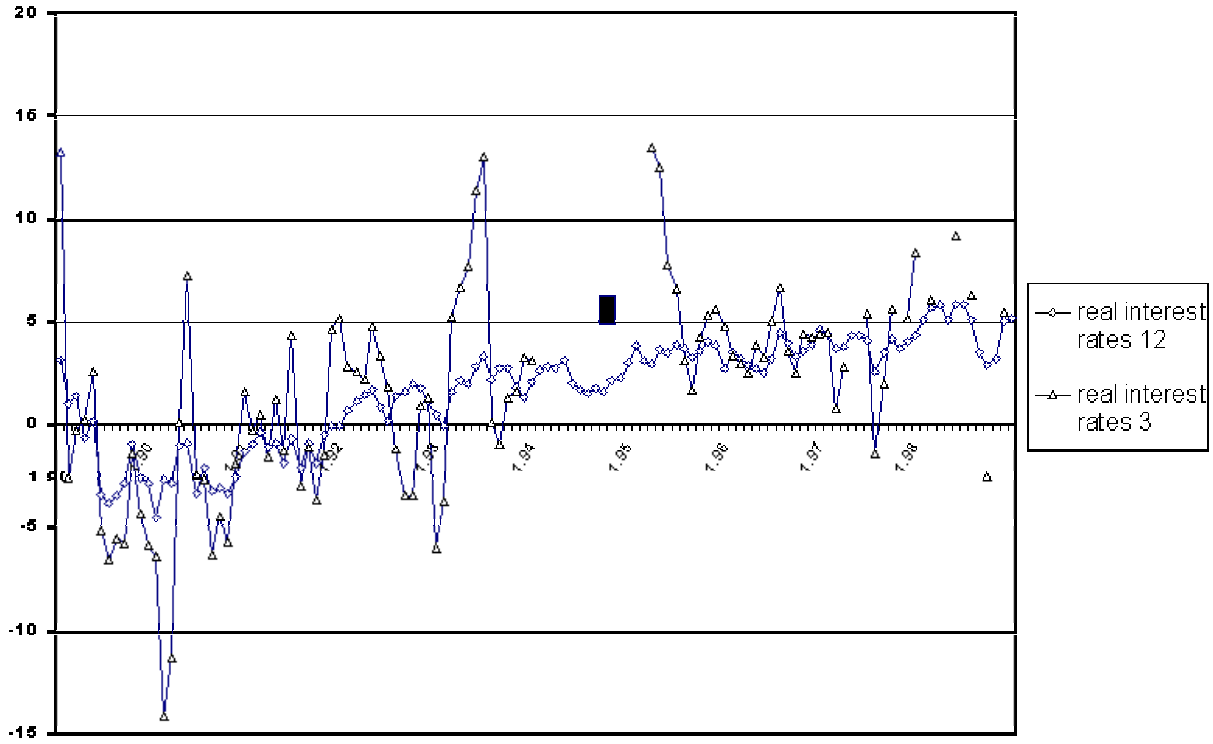
Source: Tel-Aviv Stock Exchange.

Figure 4. Expected Inflation Rates 3 and 12 Months
(1989–98)



As stated, expectations can be estimated for different periods. As Figure 4 shows, yearly expectations fluctuate considerably less than those for three months, reflecting both the seasonal nature of price increases, and the fact that this is taken into account in forming expectations. Fluctuations in real interest over three months do not appear significantly to affect the decisions of economic agents. In these seasonal periods real interest for three months fluctuated widely (Figure 5). Most contracts for these periods are not indexed, so that decisions are taken in nominal, not real, terms. The significance of this factor for policy purposes is that the rate of interest determined by the Bank of Israel need not be affected by the seasonality of the CPI.

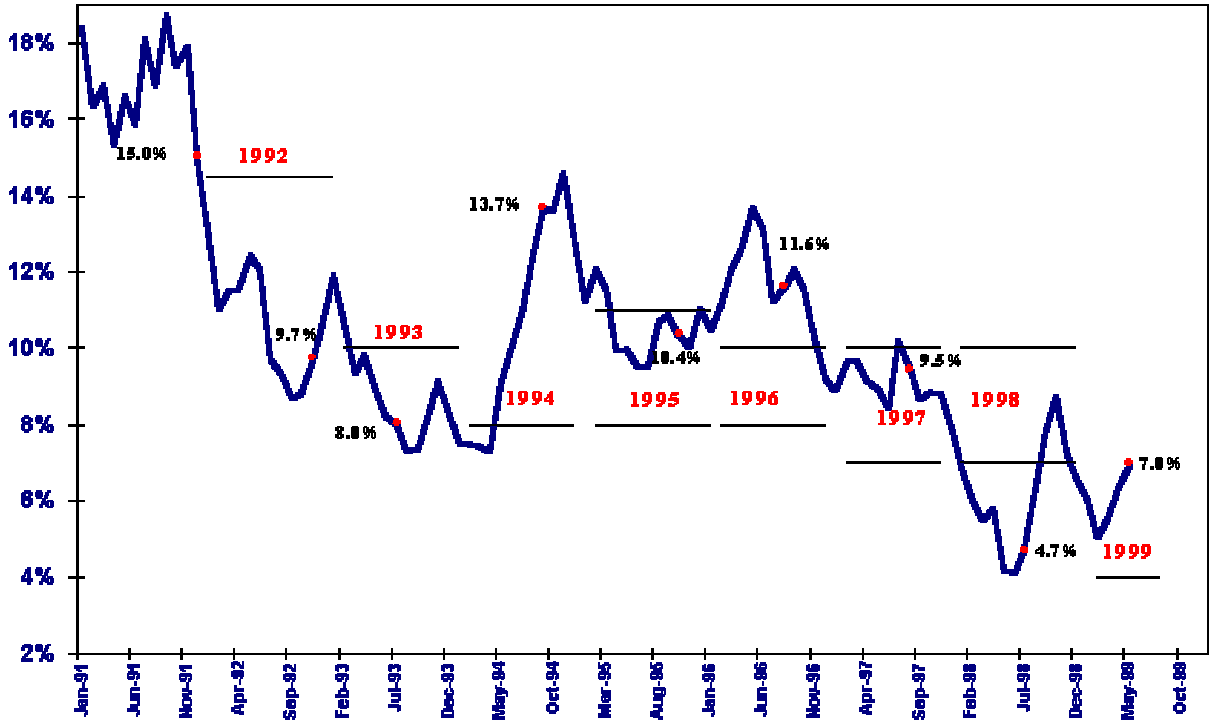
Figure 5. Real Interest Rates for 3 and 12 Months
(1/1989–12/1998)



The inflation target policy

At the end of 1991, the Bank of Israel adopted a monetary policy based on announcing an inflation target for the next calendar year, together with the slope of the exchange-rate band, adjusted for the target. The object of announcing the inflation target was to provide stability and reduce uncertainty regarding inflation and the exchange rate, as well as to supply a framework enabling policy makers to reduce inflation gradually (Figure 6) (for a review and initial assessment of this policy, see Bufman, Leiderman, and Sokoler, 1995).

Figure 6. Inflationary Expectations (12 months) and the Inflation Targets (1989–98)



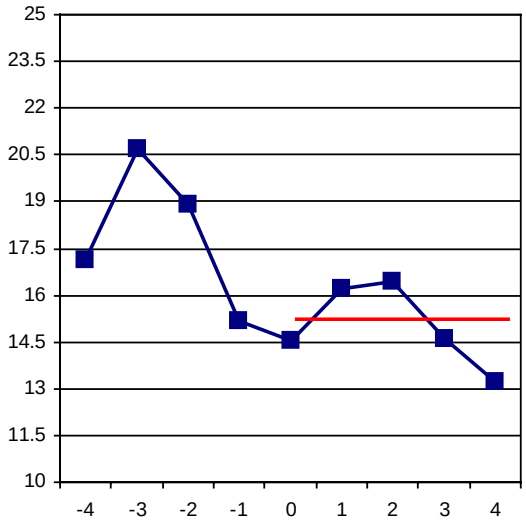
Dates of inflation target announcements

Inflationary expectations may indicate the credibility accorded to the target inflation figure. The development of annual inflationary expectations at the time of the announcement of the target is shown below, and is compared with expectations for that calendar year. It is clear that other changes influencing the results may occur at the same time. The important point is that it is not the announcement itself which is likely to affect the public, but the extent of the policy makers' commitment to adopting the appropriate fiscal and monetary policies required to achieve the target.

On December 16, 1991, the crawling-band exchange-rate policy was announced, and an inflation target of 14.5 percent was set for 1992. Figure 7a shows the data relating to the time of the announcement is for a week, and refers to four weeks before and after it (weeks are defined by the dates 16–23, 24–31, 1–7, and 8–15 of each measured month). The same figure illustrates that there was a significant fall in inflationary expectations, from 18–20 percent per year to about 16 percent. It should be noted that in the same month the rise in the CPI for November of only 0.1 percent was published. On November 8, 1992, the target inflation rate of 10 percent for 1993 was announced, and there was a marginal rise in expectations, which were around the target level. On July 24, 1993, an 8 percent target rate for 1994 was announced (Figure 7c). Considerable pressure to reduce interest rates was exerted on the Bank of Israel. Inflationary expectations declined from 11 to 10 percent, remaining 2 percent higher than the target rate. Alongside the announcement, interest at the discount window was

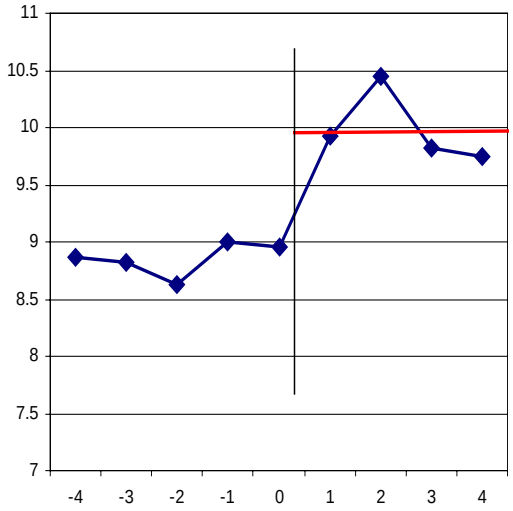
Figure 7. Inflationary Expectations Before and After the Inflation Target Announcements 1992–95 (Weekly Average)

7a



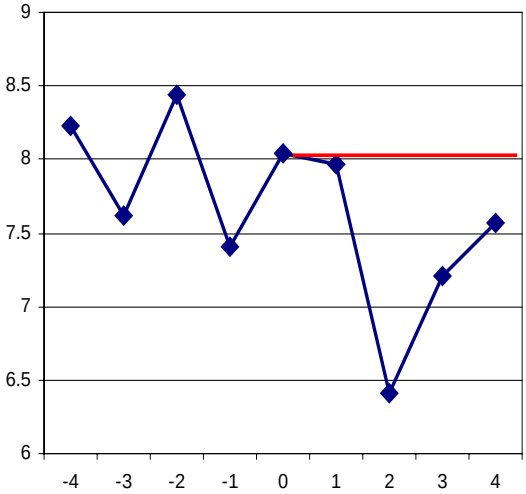
12/16/91
announcement date

7b



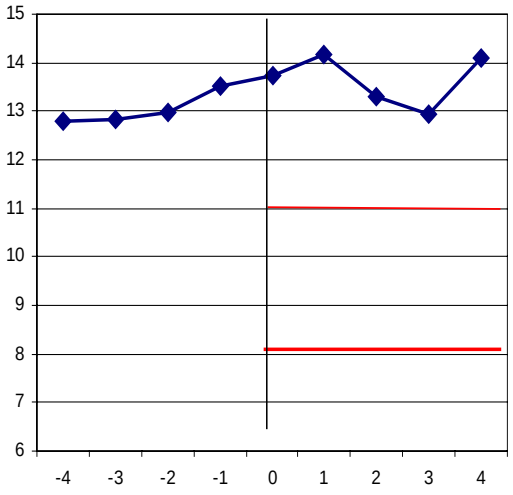
11/8/92
announcement date

7c



7/24/93
announcement date

7d

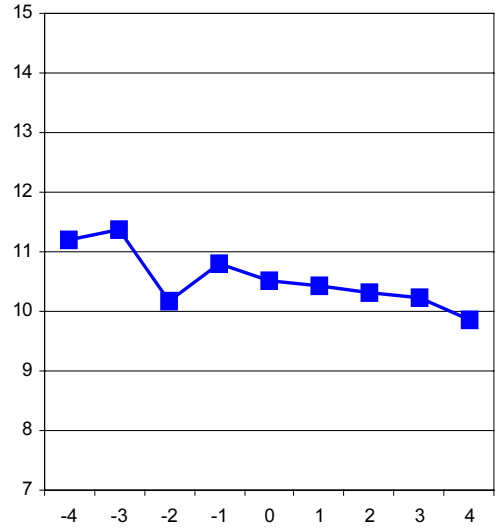


9/25/94
announcement date

reduced by about 2.5 percentage points. In September 1994 the target for 1995—between 8 and 11 percent—was announced. At that time annual inflationary expectations rose slightly, from an average of 15.3 percent to 15.8 percent after the announcement. Two points to note in this context are that, first, the target rate differed significantly from actual inflation; second, at the same time as the announcement, interest at the discount window was raised by 1.5 percentage points. Following the announcement of inflation targets for 1996 to 1998, there was a certain lowering of inflation expectations; this may have been related to the certainty that the announcements themselves instill. In August 1998, a 4 percent target was announced for 1999 following a significant decline in the rate of inflation in the first half of the year. Along with this announcement, there was an apparently unexpected reduction of 1.5 percent in the Bank of Israel key interest rate, which led, among other considerations, to some increase in inflation expectations.

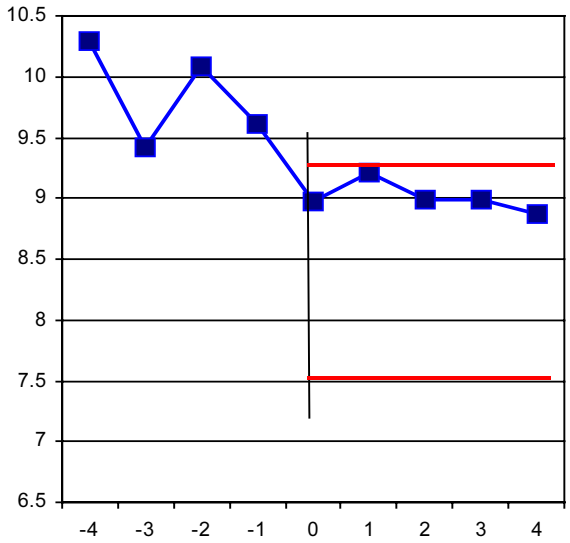
Figure 7 (cont'd). Inflationary Expectations Before and After the Inflation Target Announcements 1996-99 (Weekly Average)

7e
5/7/96 Target



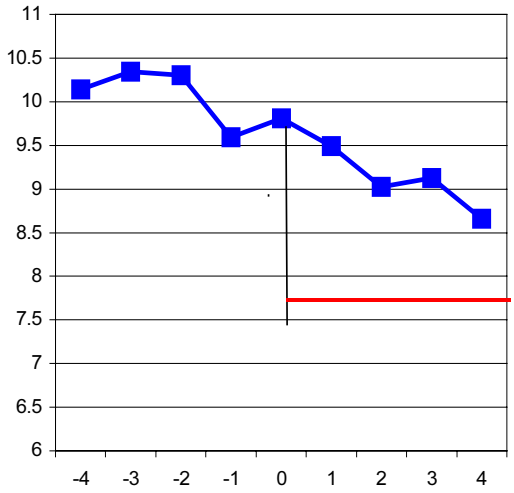
10/1/95
announcement date

7f
6/7/97 Target



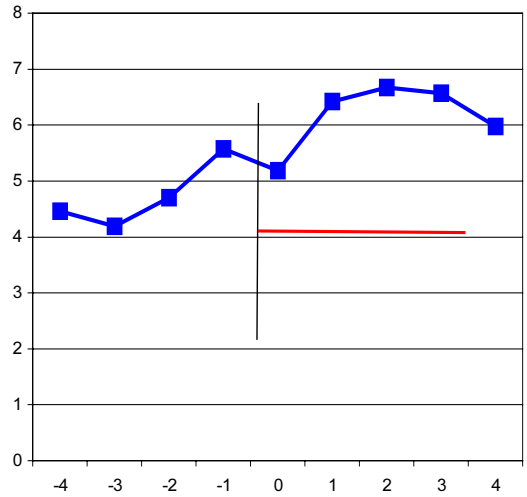
12/17/96
announcement date

7g
7/7/98 Target



8/14/97
announcement date

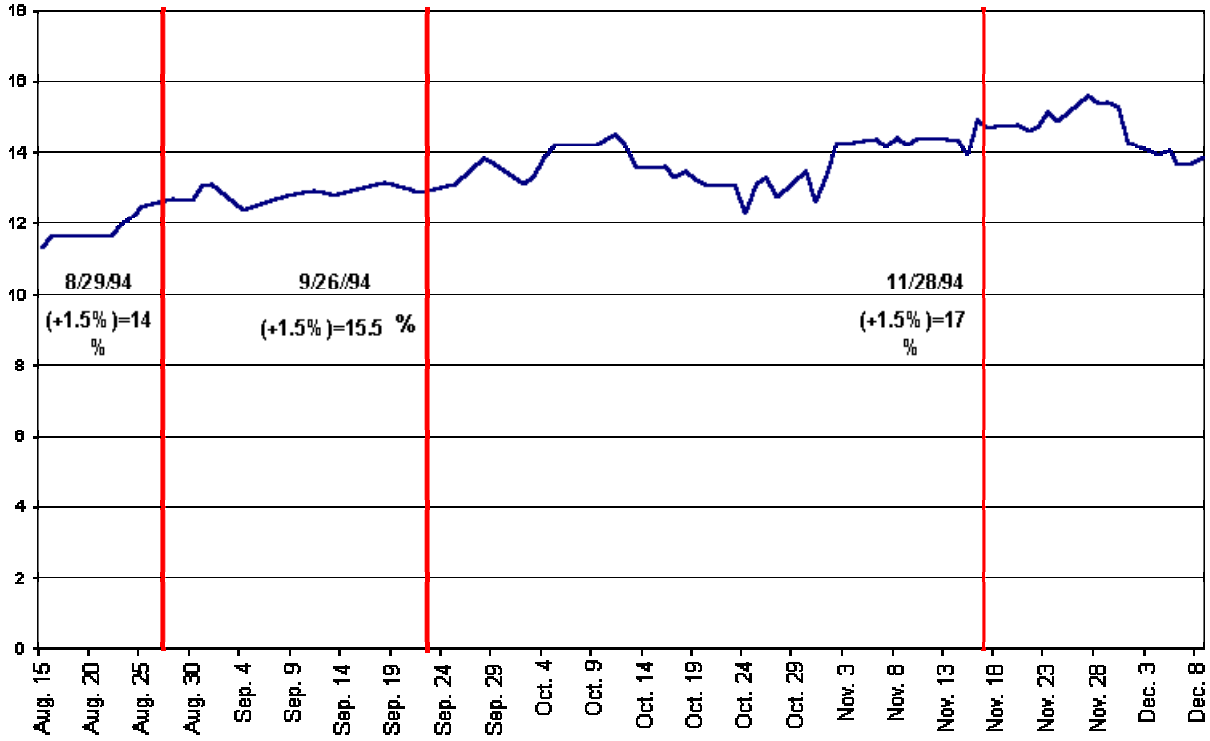
7h
8/7/99 Target



8/3/98
announcement date

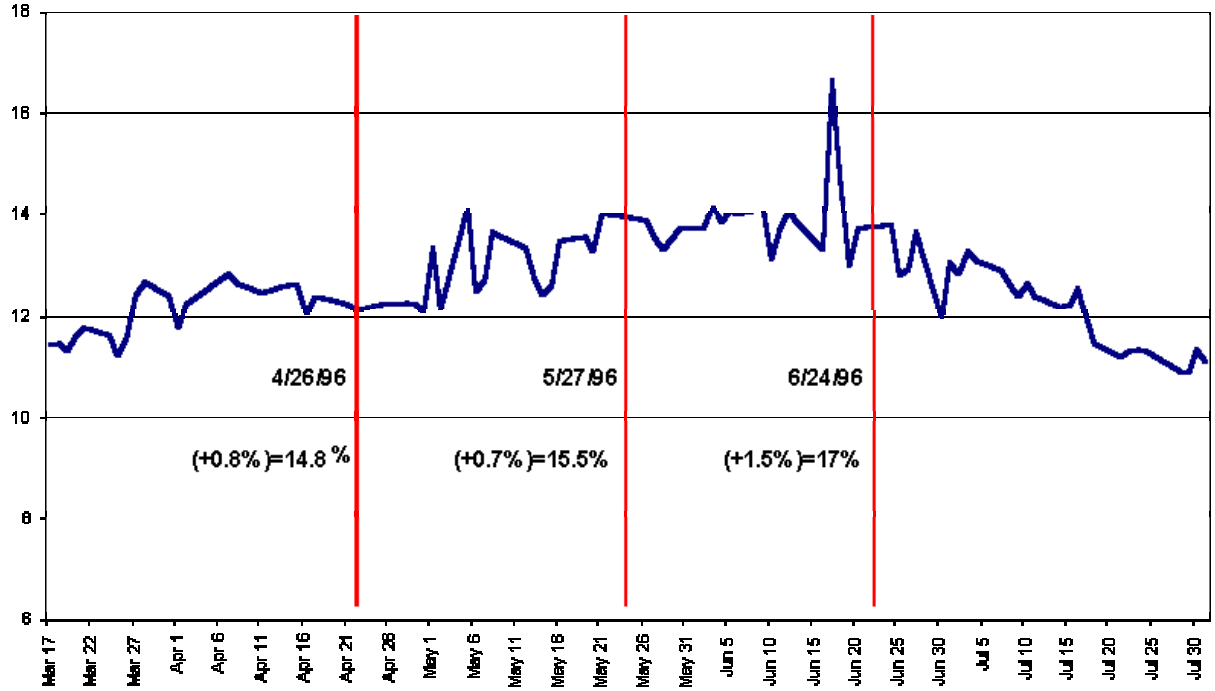
The response of the market to changes in the Bank of Israel interest rates, which were raised three times by about 1.5 percentage points each at the end of 1994, should be examined here. Figure 8.1 shows that the August rise was perceived mainly as an adjustment to bring it into line with inflationary expectations, and the Bank's notification merely confirmed the

Figure 8.1 The Impact of Monetary Policy on Inflationary Expectations 4Q 1994



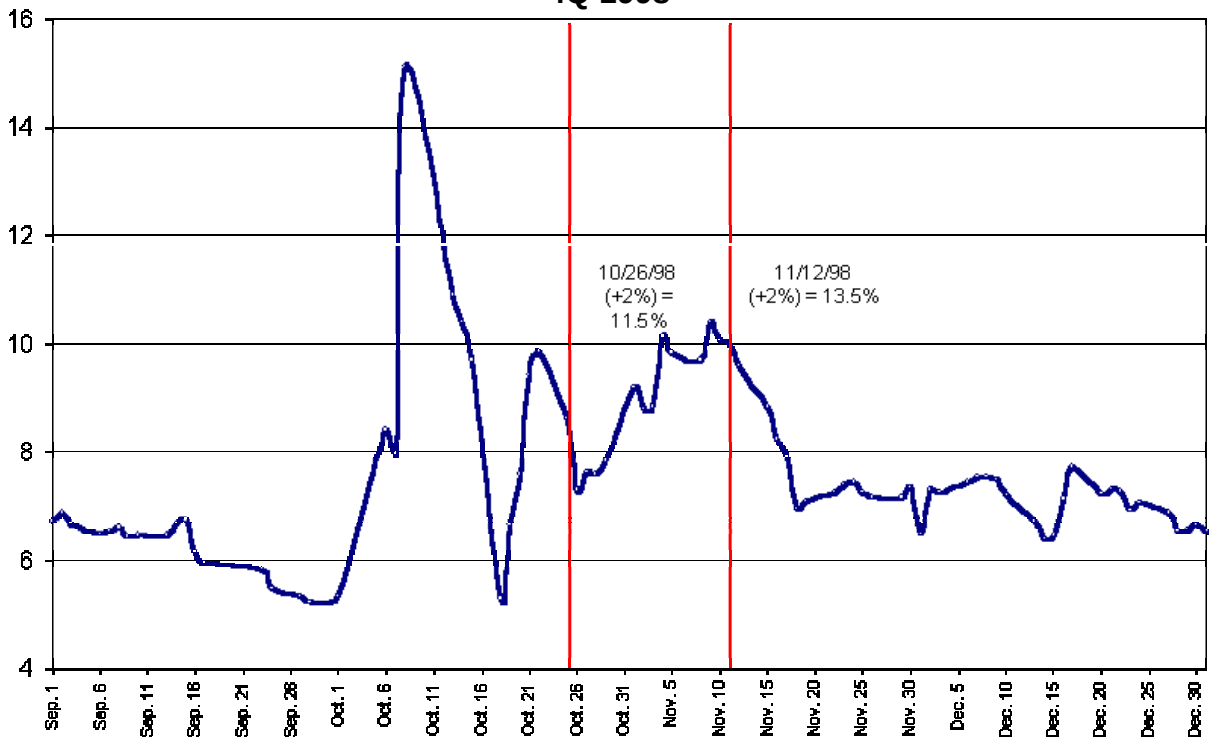
assessment that these had risen. The September increase in interest, however, (together with the announcement of the inflation target) was generally interpreted as signifying a rise in real interest, and after a further rise of 1.5 percentage points in the interest rate in November, inflationary expectations fell from 16.5 percent to about 15 percent. This indicates the

Figure 8.2 The Impact of Monetary Policy on Inflationary Expectations
2Q 1996



credibility earned by the Bank of Israel's determination to achieve the inflation target, following the steady increases in nominal interest. In the last quarter of 1998, following a rise in inflation expectations in the wake of the rise in the exchange rate, expectations fell again after the increase in the Bank of Israel interest rate, despite the rise in the CPI (Figure 8.3). The fall in expectations allowed both the public and policy makers to make the assessment that the acceleration in the price level at the end of 1998 had been essentially a nonrecurring occurrence (among other things, due to the monetary policy response), thereby reducing the risk of a renewed more rapid inflationary spiral, with all the damage that it would cause.

Figure 8.3 The Impact of Monetary Policy on Inflationary Expectations 4Q 1998



Thus, the announcement of a target inflation rate was initially accorded a considerable degree of credibility and contributed to the reduction of inflationary expectations. As time passed, however, the announcement of a target did not appear to have a significant effect on expectations around the time of the announcement, so that changes in expectations seem to be connected with actual inflation. Nonetheless, the contractionary monetary policy at the end of 1994 and 1998 led to a significant reduction of inflationary expectations, evidence of the credibility accorded to that policy and the measures taken to achieve it.

Assessing the estimate

A first assessment of inflationary expectations may be obtained by comparing actual inflationary expectations by the average and standard deviation over different periods. As Table 1 shows, expected inflation is similar to actual inflation for all periods regarding both the average and the standard deviation. The difference between estimated and actual inflation is not more than 0.5 percent, and the standard deviation does not vary significantly either over different periods.

Table 1. Mean and Standard Deviation of Expected and Actual Inflation, by Period
(January 1988–December 1998)

	Period (months)				
	1 1/	**3**	**6**	**9**	**12**
			(percent)		
Mean					
Actual inflation	1.1	3.0	5.8	8.7	11.7
Expected inflation	1.2	2.5	5.4	8.3	12.5
Standard deviation					
Actual inflation	0.72	1.51	2.52	3.46	4.26
Expected inflation	0.81	1.02	2.10	3.13	3.98
Correlation coefficient	0.54	0.29	0.35	0.55	0.59
Difference	0.12	-0.51	-0.35	-.043	0.73
Number of observations	114	115	112	109	106

Source: Central Bureau of Statistics, Israel.

1/ Data in this column relate to January 1988–June 1997.

The analysis of expectations may also be tested by examining the rationality of the estimates obtained. The rational expectations approach states that the public's expectations of inflation (EXPINF) are not systematically biased compared with actual inflation (INF). More specifically, if we run:

$$INF = a + b \ \ EXPINF + e$$

we would expect to obtain that a=0, b=1, and the residuals will be "white noise" (i.e., unbiased and uncorrelated).

As Table 2 shows, in the sampling period, although there is no serial correlation (D.W.=1.58), a significant coefficient is obtained, but less than 1 (0.52), while the constant in the regression is significant and different from zero. On the other hand, when the sample is extended to 1984–87, a significant coefficient very close to 1 is obtained, and the constant is not significant. Thus, by extending the period to incorporate the time of very high inflation, estimates confirm the rationality test of the expectations. This result is obtained because inflation did not fluctuate enough in the 1988–98 period, and this created a bias in the test, apparently based on the Error of Variables.

Table 2. Rationality Test of Expectations for One Month and Three Months 1/ 2/

Period	No. of Observations	A	B	D.W.	R
One month					
1/88–4/97	112	0.52	0.47	1.58	0.29
		(5.0)	(6.7)		
1/84-4/97	160	-0.10	1.09	1.89	0.92
		(-0.8)	43.3)		
Three months					
1/88-4/97	43	8.33	0.41	1.56	0.07
		(3.2)	(2.0)		
1/84-4/97	55	23.94	0.50	2.33	0.47
		(1.5)	(7.0)		

Source: Central Bureau of Statistics, Israel.

1/ The estimated regression is INF = bEXINF + e: where INF is inflation, EXINF is expected inflation for appropriate period.

2/ Including observations for three months estimated in this chapter (1988–98), and expectations for 1984-86 estimated in the 1990 study. The values in parentheses are *t*–values.

Similar results were obtained from the regression of the same equations for a three-month period. Here too significant results in the expected direction and with a sufficiently high explanatory level were obtained only when the high-inflation period was included.
To summarize, inflationary expectations satisfy the rationality test, strengthening the validity of the findings and the quality of the series.

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