

Chapter 1

Investment of the Foreign Exchange Reserves¹

The management of the foreign exchange reserves portfolio, whose average level in 2001 was \$ 23.5 billion,² is subject to the Bank of Israel Law, 5714–1954, and the relevant legal interpretations which have been added over the years, and a set of rules which reflect the Bank's responsibility for the reserves (see Boxes 1.1 and 1.2). The holding-period rate of return on the foreign exchange reserves in 2001 was 6.4 percent, down from 6.8 percent in 2000, reflecting the significant decline in yield to maturity in the capital markets in 2001 which resulted from the expansionary monetary policy pursued in response to the slowdown in economic activity primarily in the US but also in Europe. In NIS terms, the holding-period rate of return in 2001 was 10.3 percent, compared to 1.6 percent in 2000, reflecting the weakening of the NIS against the currencies in which the reserves were invested in 2001.

The yield on the reserves is greatly affected by the composition of the neutral benchmark of the portfolio, due to the relatively small deviations from it. Much effort has been invested in the last few years in the areas of asset allocation (securities not in the benchmark) and security selection for the portfolio, hereafter referred to collectively as asset selection, while on the other hand the scope of positions in the areas of duration and currency management has declined, in accordance with the policy of reducing exposure in these fields. In 2001 the holding-period rate of return was 22 basis points higher than that on the benchmark; this yield differential reflects the contribution of all aspects of portfolio asset management.

¹ Appendix 1.2 contains a glossary of terms which appear in the Report. More detailed explanations of certain terms and a description of the management of the reserves are given in the Boxes. For a more detailed description of the management of the reserves see Boxes 1.1 to 1.6 in Part 1 of the 2000 Annual Report of the Foreign Currency Department.

² The average level of the reserves in this Report is calculated on the basis of daily data on the reserves assessed at their full market value. All the holding-period rates of return in this Report are in terms of the numeraire, unless stated otherwise.

Asset-selection decisions contributed 23 basis points to the yield differential in 2001. Most of this derived from investment in Treasury Inflation-Protected Securities (TIPS) (7 basis points), in Eurobonds and floating-rate notes (FRNs) (8 basis points), and securities-lending activities (5 basis points). In contrast, investment in mortgage-backed securities issued by the Government National Mortgage Association (GNMAs) reduced yield by 4 basis points compared to the benchmark, due mainly to the strategic decision to invest in this sector. The duration management contribution was a negative 1 basis point, and currency management made practically no contribution.

The exposure of the reserves to the banking system is limited to 25 percent of the value of the portfolio. In 2001 it averaged 23 percent, and much of it was used in securities-lending activities, which have a very short investment horizon. The exposure is managed under a system of quotas and rules which plays a central role in the credit-risk management of the portfolio.

The reserves had very high liquidity: about 90 percent was invested in very liquid assets, and the balance in less liquid assets. Given the high level of the reserves, the liquidity appears to be satisfactory.

The terrorist attacks on the World Trade Center and the Pentagon on September 11 caused shocks world wide. In the wake of the attacks, the US economic slowdown worsened, and the level of uncertainty in the markets rose. Activity in the financial markets, which was severely disrupted in the days following the attacks, recovered relatively quickly, largely due to the immediate steps taken by the US Federal Reserve Bank in cooperation with several other central banks. (For a description of the sequence of events at that time and the implications for the management of the reserves see Box 1.3.)

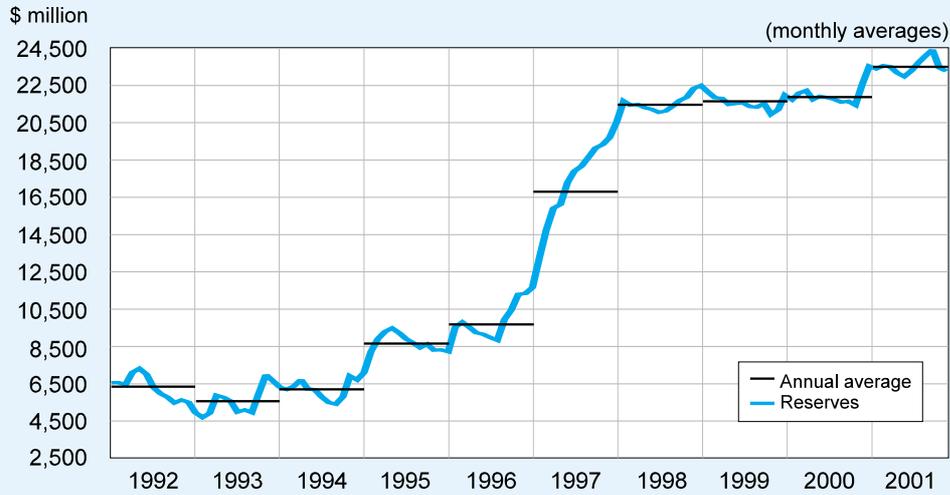
1. THE LEVEL OF THE RESERVES

The level of the foreign exchange reserves in 2001 was slightly higher than in the years 1998 to 2000, and far higher than their previous levels.

The average level of the foreign exchange reserves in 2001 was \$ 23.5 billion, slightly higher than in the years 1998 to 2000, and far higher than their level in any previous year (Figure 1.1). In the years when the reserves rose sharply, particularly in 1997 and 1998, their increase considerably exceeded that of other aggregates such as imports, the external debt, local-currency assets held by the public, and the monetary base (Table 1.1). The reserves reached their peak vis-à-vis the other aggregates in 1998. As the level of the reserves did not change greatly in dollar terms in 1999 and 2000, they declined somewhat relative to most of the other aggregates, but then rose again in 2001.

In the course of international discussions held during the last few years it has been suggested that adoption of a target level of foreign exchange reserves similar to the level of short-term debt (i.e., debt repayable within one year) could help to maintain the confidence of foreign investors, and thus contribute to economic stability. The Bank of Israel has not adopted this as a guideline in determining its desired level of reserves because it could be interpreted as some sort of central-bank guarantee for the

Figure 1.1
Gross Foreign Exchange Reserves, 1992–2001



SOURCE: Bank of Israel.

private sector's external debt, which would run counter to policy and might become a source of moral hazard. The fact that the level of Israel's foreign exchange reserves is close to the level of the short-term debt is therefore just a coincidence (see Box 1.1).

Table 1.1
The Level of the Reserves Relative to Other Aggregates, 1991-2001

	Imports (months)	Gross external debt ^a	Short-term external debt		Unindexed local- currency assets	Monetary base	Local- currency liabilities in Bank of Israel balance sheet ^b
			excluding suppliers' credit	including suppliers' credit			
			(percent)				
1991	3.2	21	59	–	70	328	–
1992	2.7	18	55	–	58	283	–
1993	2.1	15	44	–	45	219	–
1994	2.1	15	43	–	35	208	–
1995	2.5	19	50	–	37	295	139
1996	2.6	21	49	–	35	288	107
1997	4.6	31	84	69	52	466	110
1998	6.2	37	108	92	61	520	111
1999	5.5	35	102	86	55	503	105
2000	4.9	34	–	79	46	442	97
2001	6.1	35	–	89	43	420	99

^a From 1997 this includes suppliers' credit. In 1997 this inclusion reduced the ratio of the reserves to the gross external debt by 2 percentage points.

^b These liabilities include the monetary base, interest-bearing deposits of the banks, and the Treasury bills deposit.

SOURCE: Bank of Israel, The Central Bureau of Statistics, and returns from the banks.

Box 1.1: The Purpose of Holding Foreign Exchange Reserves, their Optimal Level, and their Neutral Currency Composition

The background to current investment policy

From the implementation of the Economic Stabilization Program in 1985 until a few years ago the main purpose of the foreign exchange reserves, apart from the traditional one of providing a ‘liquidity cushion’ for emergencies, was to provide the liquidity required by the Bank of Israel for intervening in the foreign exchange market and defending the exchange-rate regime. This situation prevailed in the context of macroeconomic policy based on a fixed exchange rate or a regime managed according to strict rules, which served as a nominal anchor for the level of prices. According to this approach, monetary policy defended the exchange rate by using the interest rate and the foreign exchange reserves, against the background of tight controls on foreign currency and an absence of any significant interbank foreign-exchange trading.

The Bank of Israel Law, 5714–1954 and the responsibility for managing the foreign reserves led the Bank to formulate a cautious investment policy, one of whose most important principles was the preservation of the real value of the reserves. In this context, in the mid-1980s a neutral *currency composition*, known as the *numeraire*, was adopted. This serves as the Bank of Israel’s currency-risk-free portfolio and as a benchmark for assessing the performance of the reserves portfolio. The composition of the numeraire was initially determined on the basis of the geographical distribution of goods and services imports.¹ This composition was intended to preserve the real purchasing power of the reserves, as imports constitute the foreign currency component of Israel’s total final uses. A few years later another element was added to the composition of the numeraire, namely, the currency composition of the external debt-service for the coming year, so that the numeraire also provides some degree of protection from the currency risk of Israel’s external debt. Another consideration in determining the currencies included in the numeraire has been that they are ‘reserve currencies,’ i.e., currencies of countries with a tradition of economic stability and responsible policies in various fields. The currency composition of the numeraire described here has been stable over time, and on the basis of an international comparison was found to resemble that of the total reserves held by official authorities throughout the world. Nevertheless, over the years the subject of the numeraire has been examined several times at the Bank of Israel. To date no changes have been made to the above approach, because the alternatives reviewed offered no clear advantages. The currency composition in the other systems was found to change drastically from year to year, and such changes raise doubts regarding the credibility of the systems, and make their implementation more difficult and costly.

¹ The system was based on the 1979 study by A. Ben-Bassat, “The Management of Foreign-Exchange Reserves, Israel’s Experience,” Research Department, Bank of Israel (Hebrew), an abridged English version of which was published in the May, 1981 *Bank of Israel Economic Review*.

Over the years the Bank of Israel has also examined the extent to which the *level of the reserves* is reasonable, although the flexibility to initiate any change in it was and is limited. Until the middle of the 1980s the accepted index for determining the optimum level was the amount needed to cover three months of imports. This index was appropriate for a situation in which capital flows were fairly limited and the reserves were perceived as a source of liquidity in times of crisis, when foreign currency was needed immediately to finance imports. Later studies took the volatility of capital flows into account together with other factors. On the basis of those models the optimum level of the reserves at the beginning of the 1990s was estimated at between \$ 5 billion and \$ 6 billion, near their actual level at that time.

The appropriateness of the current investment policy for the present situation

The level of the foreign exchange reserves rose steeply in the years 1995–97, and remained steady at an average of \$ 22 billion from 1998 to 2001. In the last few years Israel's macroeconomic policy also changed radically, and is currently based on a declared inflation target and not on the exchange rate as a nominal anchor for the price level. The government made the decision to reach price stability in 2003, with the inflation target converging to a range of between 1 percent and 3 percent in that year; monetary policy is committed to achieving and maintaining that target. This change enabled a number of developments to take place in the area of foreign exchange: first, the exchange-rate regime has become substantially more flexible—the exchange-rate band has been widened gradually and at the end of 2001 its width (based on the average rate of its limits) was 43.9 percent. Second, for more than four years the Bank of Israel has refrained from intervening in trading in the foreign currency market and has declared a policy of non-intervention in trading within the exchange-rate band. Third, the process of foreign exchange control liberalization will be completed on 1 January 2003, and in effect Israel's economy has been open to capital flows for several years. These changes also boosted the development of Israel's foreign currency market, which has moved to the bilateral trading system accepted as the norm in the international foreign currency markets.

Concurrently, world financial markets have also been changing rapidly. The globalization process intensified the interaction between countries not only due to the expansion of trading relations between them but also due to the surge in international capital flows. This led to the development of sophisticated financial instruments, which can result in tremendous losses if their inherent risks are not managed properly. The above developments were accompanied by financial crises that affected mainly those emerging markets which had not devised mechanisms for maintaining stability in the new financial world.

In view of the economic changes in Israel, even though the exchange-rate band has not yet been annulled, the reserves are no longer important as a source of liquidity for managing exchange-rate policy. Several questions arise in

consequence, such as the purpose of maintaining foreign exchange reserves in the current circumstances, the optimum level of the reserves, the appropriate risk-management rules for the present time, and in particular, the currency composition of the numeraire.

The objectives of maintaining the reserves

In view of the experience acquired throughout the world, especially at times of financial crises, and based on the professional literature dealing with reserves, it is possible to identify several key functions currently fulfilled by Israel's foreign exchange reserves:

- ◆ *Reducing the probability of a crisis in the foreign currency market.* Studies undertaken in the last few years under the aegis of the IMF and the World Bank have shown that the higher the level of a country's foreign reserves, the smaller the probability that there will be a crisis in its foreign currency market. This is because the knowledge that the central bank has access to a large reserve of foreign currency calms foreign investors and the country's residents on the one hand, and deters speculators on the other. The importance of the reserves in preventing crises in the foreign currency market is secondary, however, to the importance of a responsible, credible macroeconomic policy which acts to achieve economic and financial stability.
- ◆ *The reserves serve as the country's international liquidity* for dealing with a foreign-currency market crisis (together with other policy instruments, such as the interest rate), should one arise, or for use in a national emergency. In such situations the higher the level of the reserves, the greater the economy's resilience, and the wider the range of options available to policy makers.
- ◆ *The reserves improve a country's status in the international financial environment.* Important entities in the international capital markets, including the major rating agencies, perceive the level of a country's foreign exchange reserves as an important indicator of its financial stability. An improvement in their evaluation of the country, which may also be reflected in a higher credit rating, eases its access to international capital markets and helps to lower its cost of raising capital.
- ◆ *The reserves allow the government a certain flexibility in managing the currency composition of its liabilities.* The government transfers its foreign currency receipts to the Bank of Israel² and has the legal right to purchase foreign currency directly from the reserves. The government can finance repayment of its current external debt from its income in foreign currency or by taking new foreign currency credit (i.e., by rolling over the debt). Alternatively, it can finance repayments from local-currency sources and purchase foreign currency from the Bank of Israel for that purpose. This use of the reserves is not worthwhile, however, because if it reduces them by a

² These receipts are converted into NIS, unless their receipt is conditional on their being held in foreign currency.

significant amount, their ability to fulfill the other functions outlined above will be curtailed.

The desired level of the reserves

One of the conclusions drawn from research into the financial crises of recent years was the importance of a high level of foreign exchange reserves. The renowned American economist Martin Feldstein³ has listed four situations which led to financial crises in different countries: (1) a persistent deficit in the current account, relevant only in the case of a country with a fixed-exchange-rate regime. The other three situations, on the other hand, can occur under either fixed- or floating-exchange-rate regimes, and they are: (2) lack of liquidity in the country's balance of foreign currency assets and liabilities (e.g., Korea in 1997); (3) a run on the banks, leading to a flight of capital; and (4) contagion from a crisis in another country resulting from geographical proximity, international trade, or a change in foreign investors' investment policy. In Feldstein's view, in all these cases a sufficiently high level of reserves can prevent or significantly reduce the intensity of the crisis. This is an important role played by the reserves, as a sudden and sharp depreciation of a currency—by several tens of percentage points over a brief period—is quite likely to harm growth and undermine the stability of the financial system, as has occurred in several countries in the last few years.

The conclusion to be drawn is that a high level of reserves is beneficial, as it reduces the probability of a crisis, lessens its seriousness, and reduces the cost to the economy of raising capital, and indeed, many countries have raised the level of their reserves in the last few years. Nevertheless, there is a price to be paid for the increase, as the return on the reserves is generally lower than the cost of borrowing money domestically or from abroad.

This raises the question of the level of reserves needed to attain the objectives for which they are held. A rule of thumb proposed by Pablo Guidotti while he was Deputy Finance Minister of Argentina is that the required level of liquidity is such as to enable the economy to operate without renewing foreign currency loans for a year, i.e., a level equal to the country's external debt due for repayment in the coming year.

The implementation of the Guidotti rule can be interpreted in different ways, but it can be claimed nonetheless that the level of Israel's reserves more or less conforms to it (Table 1.1). However, it must be emphasized that this is not the result of a policy decision. The Bank of Israel has not adopted the Guidotti rule to determine its desired level of reserves, because its adoption might be viewed as some form of guarantee for the private sector's external debt, which would run counter to policy, and could constitute a source of moral hazard. Nevertheless, in setting the desired level of the reserves, there could be room to take into

³ Feldstein, M. (1999), "Self-Protection for Emerging Market Economies," *NBER Working Paper 6907*, available on <http://www.nber.org/papers/w6907>, or in a more popular version, in "A Self-Help Guide for Emerging Markets," *Foreign Affairs* 78(2), 93–109.

consideration the size of the government's external debt due for repayment in the next few years, along with other factors.

Other approaches regarding how to determine the desired level of the reserves relate it to the size of the economy, as measured by GDP or monetary aggregates, and to its degree of openness: the larger an economy and the greater its dependence on international ties, the higher the level of reserves it tends to hold. An analysis performed by the Foreign Currency Department of the Bank of Israel showed that the risk of serious currency crises exists mainly in situations in which the level of the reserves is not in proper proportion to the size of the economy. Using this approach, it appears that the level of Israel's reserves is not greatly different from the desired level.

Both approaches, that using ratio of the reserves to the public-sector external debt and that using the relationship of the reserves to the size of the economy, require further research, which is currently being undertaken.

The currency composition of the numeraire

In view of the above reasons for maintaining the reserves and of the marked rise in the level of the reserves in recent years, the system for determining the numeraire should be re-examined. If the reserves are intended to reduce the probability of a crisis and to improve Israel's financial standing, the criteria for choosing the currency and assets composition of the portfolio should be long-term stability and reasonable profits. On the other hand, as the reserves can be used—to repay the government's external debt in quiet times, or for other needs during a crisis or other emergency—these situations should be considered too in determining the currency composition.

Regarding the repayment of the government debt, both the currency composition and the duration of the government's external debt can be hedged against. However, hedging against this debt in its entirety is likely to expose the reserves to high volatility, which would adversely affect the fulfillment of their other functions. Moreover, if the use of the reserves reduces their level too greatly, the stability of the foreign currency market could be undermined. It is advisable therefore to settle for partial hedging.

Regarding the use of the reserves to handle a crisis (which has a very low level of probability) or in an emergency, reasonable hedging of the national requirements must be based on a wider coverage of risks and on an analysis of the various possible scenarios. It must also take account of all the public sector's assets and liabilities, both on-balance-sheet and contingent, as mentioned in some international debates on the subject,⁴ because in such circumstances the government's foreign currency requirement is not restricted to the repayment of its external debt.

The question of the currency composition is also under review in the Foreign Currency Department.

⁴ Federal Reserve Board (1999), "Liquidity and Risk Management for Emerging Market Countries (Revised)," a background paper for a meeting of the G-10.

Box 1.2: The Investment Policy of the Foreign Exchange Reserves¹

Like most central banks, the Bank of Israel is responsible for investing the country's foreign exchange reserves. The Bank's authority regarding the management of the reserves derives from the Bank of Israel Law, 5714–1954, and the relevant legal interpretations which have been added over the years. These define the ways the Bank may conduct its activities in foreign currency, and limit the types of assets the Bank may purchase. They allow the Bank to hold gold, foreign currency, securities issued by foreign governments and securities fully guaranteed by them (e.g. mortgage-backed securities issued by the US Government National Mortgage Association—GNMAs), to invest in banks' time deposits and in tradable certificates of deposit (CDs), and to use derivatives such as futures contracts and options, on condition that their underlying asset is one that the Bank is permitted to hold. The Bank may perform transactions with banks outside Israel, with traders who are investment banks, and with a small group of domestic entities such as the government and banking corporations. In areas in which the Bank is not restricted by the provisions of the law, such as the choice of currencies or countries to invest in, it always tends to follow a conservative policy, with its guiding principle being the preservation of the real value of the reserves.²

To ensure that the management of the reserves portfolio is appropriate to the achievement of the purposes for which they are held³ in a changing financial environment, a set of detailed rules has been developed over the years, and the management of the portfolio's exposure to the different financial risks follows these rules. This framework, which incorporates the main directives for managing the reserves and the degree of leeway allowed in the day-to-day activities of the Foreign Currency Department, is formulated by the Foreign Currency Committee headed by the Governor of the Bank of Israel. The main financial risks are liquidity risk, credit risk, interest-rate risk and currency risk; additional risks include operational risk and legal risk (see Appendix 1.2 for definitions).

The overall policy regarding investment of the foreign exchange reserves is expressed by their level of *liquidity*, which generally is high, as a large part of the reserves is invested in bonds traded in deep and liquid markets. The part of the portfolio that is not negotiable consists of banks' deposits repayable over the very short term.

Credit risk is managed by means of a system of quotas and rules which gives control over the portfolio's level of exposure to the institutional risk of banks, brokers, and countries. It sets a minimum quality threshold for a single

¹ The topics in this Box are discussed in greater detail in the 2000 Annual Report of the Foreign Currency Department, Boxes 1.1 to 1.6.

² For the difference between foreign-currency activities permitted by law and those permitted according to legal interpretation of the law see Box 1.2 in the 2000 Annual Report of the Foreign Currency Department.

³ Described in Box 1.1 above.

institution's credit, and also ensures a proper distribution between the various institutions and countries in accordance with their size and credit quality. Another instrument used to control credit risk is the ceiling on the total exposure of the reserves portfolio to the worldwide banking system. In the last few years this ceiling was 20 percent of the reserves, and in November 2000 it was raised to 25 percent (see Box 1.7).

Control over interest-rate risk and currency risk is exercised by means of the *benchmark portfolio*, together with the limitations on permitted deviations of the actual portfolio from it. The benchmark is a hypothetical portfolio consisting of various assets, including derivatives such as futures contracts and options, put together according to known, fixed rules. The Bank's management, as representatives of the law and the public interest, uses benchmarks as a means of control over the risk characteristics of the foreign exchange reserves portfolio and as a standard for assessing the yield obtained by the Foreign Currency Department on its investment. The overall neutral benchmark of the reserves portfolio is based on a neutral currency composition, called the numeraire, and a currency benchmark for each of the currencies which make up the numeraire.

The numeraire comprises fixed weights of several currencies determined approximately according to the geographical distribution of goods and services imports and the currency composition of external debt-service in the coming year (see Box 1.1). The numeraire serves as an instrument for controlling *currency risk*. It is perceived as a currency-risk-free composition, any deviation from which is defined as a position, and it acts as a yardstick for measuring the quality of currency management of the reserves portfolio. The Foreign Currency Department may open limited positions around the currency composition determined by the Foreign Currency Committee.

Interest-rate risk of the reserves portfolio is controlled mainly by setting a target average duration for each of the currency portfolios. Duration is the ratio of the relative change in price to the change in the opposite direction of the yield to maturity. The longer the duration of an asset portfolio, the higher the capital gains it makes as yields to maturity decline, but the more it loses as yields to maturity rise. At the beginning of 1999 the target duration for each currency benchmark was set at about 16 months, having stood at 12 months for several years; the change resulted from research which examined the minimum expected yield compared to the market yield. This short duration leads to relatively low sensitivity of the value of the portfolio to changes in the yield to maturity. The Foreign Currency Department is authorized to open positions of limited scope vis-à-vis the neutral duration in the various currency portfolios. An asset distribution in the portfolio different from that in the benchmark also entails interest-rate risk, and is defined as a position. The department monitors this risk by means of partial duration and Value-at-Risk (VaR) (see Appendix 1.2).

The reserves are invested in assets whose yields to maturity exceed those on

government bonds in their local currency: deposits, Eurobonds, floating interest securities, GNMA, inflation-indexed securities, etc. These assets, called spread assets, are not generally included in the currency benchmarks, so that every investment in them opens a position. The Foreign Currency Department sets itself a ceiling on the extent of its investment in certain types of spread assets (see Box 1.4).

The Bank of Israel uses *active* as opposed to *passive management* (the latter means copying the benchmark exactly). Hence, the actual portfolio usually differs from the neutral benchmark in terms of currency composition, duration, kinds of assets, and their distribution along the yield curve. The added value of active management is expressed by the yield and risk differentials between the actual portfolio and the benchmark. The Foreign Currency Department measures the contribution of different types of decision to the total yield differential. Among other things, it measures the contributions of currency positions, the long-term position in the GNMA sector, change-of-duration positions in the various currency portfolios, spread-asset positions, and asset-dispersion positions along the yield curve.

Box 1.3: The Terrorist Attacks on 11 September 2001—Their Effect on Market Activity and the Management of the Foreign Exchange Reserves

The operation of the markets and the payments systems in the US in the days following the attacks

The terrorist attacks in the US caused unprecedented disruption to the financial system in the US. Nevertheless, the markets recovered quickly and continued providing the most essential services. To a great extent the recovery was due to the energetic and immediate steps taken by the Federal Reserve Board (the Fed) in conjunction with other market authorities, and to a high degree of preparedness to cope with emergencies in the main financial institutions. A brief description of the events in the days after the attacks follows.

- ◆ The *payments systems* the Fedwire and CHIPS systems, the most important and critical of all the payments systems, operated as normal from the day after the attacks. The operation of the Fed systems was transferred to an alternative site without a hitch.
- ◆ Most *banks* succeeded in operating their systems from primary or secondary back-up sites within a short time. In some cases the operation from a secondary site was limited. One such instance was the Bank of New York, an important supplier of custody services to the Treasury market and one of the most seriously affected banks, as both its operating systems and its primary back-up systems were located in the area attacked.

- ◆ The local *communications systems* and electronic infrastructures were damaged, as a result of which some transactions were not settled in the week following the attacks despite the low level of trade.
- ◆ The *reaction of the Fed*: Liquidity in the market was supported by immediate massive injection by the Fed supplied in various ways.
 - Domestic banks were encouraged to avail themselves of the discount window; loans at the window totaled \$ 45 billion on the day after the attacks, compared with \$ 200 million in the whole of the previous week.
 - On the first, second and third day after the attacks additional liquidity of \$ 38 billion, \$ 70 billion and \$ 81 billion respectively was injected via open market operations, compared with less than \$ 6 billion on a normal day.
 - The group of securities accepted by the Fed as collateral in such transactions was extended.
 - 30-day currency swaps between the Fed and the European Central Bank (ECB), the Bank of England and the Bank of Japan totaling \$ 90 billion enabled the central banks of the various countries to lend dollars to their domestic banks.
 - In addition to the direct injection of liquidity, the Fed encouraged the banking system to make credit lines available to American companies and to ease conditions for those who were not usually problem customers. It also notified the banks that the authorities would adopt a flexible approach in this difficult hour towards the capital adequacy requirements normally applicable to the banks.
- ◆ Immediately following the terrorist attacks trade in *US Treasuries* was stopped. It resumed partially two days later, with a delay on the value date for settling transactions. Ten calendar days later trade and settlement reverted to normal.
- ◆ The *repo market* thinned out considerably after the attacks, due mainly to the serious operational problems of the Bank of New York and the freezing of activity by several large holders of Treasuries. The market returned to normal functioning after about two weeks. The repo market is a very important source of dollar liquidity, so that its temporary paralysis intensified the liquidity problem in the market.
- ◆ The *New York stock exchanges* were closed for one week following the attack.
- ◆ The *commodity exchanges* were closed for two days.
- ◆ Trading in *Treasuries futures* was adapted to the conditions of trading in Treasuries themselves.
- ◆ The Treasury *yield curve* became much steeper, with its short part declining, against the background of the liquidity injection by the Fed and expectations (which were realized) of a cut in the interest rate.
- ◆ Initially *yield spreads* between the swaps curve and the Treasuries curve

widened, and then contracted as the swaps curve flattened

- ◆ *Yield spreads* between corporate bonds and Treasuries increased unevenly: bonds rated higher than BBB were affected only slightly, while those with lower ratings were seriously affected.

Management of the reserves after 11 September

In the period following 11 September the Foreign Currency Department adapted its activities to the situation in the global financial system:

- ◆ In order to minimize possible hitches in cash-flow management the balance of cash in dollars was increased. Short-term investments were directed to bank deposits, the market least affected.
- ◆ To reduce exposure to operational and settlement risks, activity in the portfolio was curtailed (this step was also requested by the Fed). Repo and reverse repo transactions which reached maturity were extended.
- ◆ The financial risks of the portfolio (currency and market risks) were managed as normal.

Conclusions drawn regarding the management of the reserves

- ◆ The conservative policy regarding the investment of the reserves, which takes into account a wide range of risks, passed the test in time of crisis. In particular, the importance of spreading the reserves over various investment instruments, several markets and several currencies was proved, as was the importance of using various settlement systems and institutions which serve as correspondents and custodians of securities.
- ◆ The crisis also drove home the great importance of preparing plans for ensuring continuity and recovery, and particularly of preparing appropriate back-up for buildings, communication infrastructures, data systems and even manpower.

2. THE YIELD ON THE RESERVES AND ANALYSIS OF PERFORMANCE

a. The yield on the portfolio and on the benchmark

The holding-period rate of return on the foreign exchange reserves is generally assessed by the Bank of Israel in terms of a basket of currencies which reflects the composition of imports and debt repayments—the numeraire (see Box 1.1). The total holding-period rate of return in terms of the numeraire was 6.4 percent in 2001, down from 6.8 percent in 2000, but above the average of 5.6 percent in the years 1992–2001 (Table 1.2 and Figure 1.2). In NIS terms the return was 10.3 percent in 2001, compared with 1.6 percent in 2000. The local-currency return in 2001 reflects the weakening of the NIS against the currencies in which the reserves are invested, in contrast to its strengthening in 2000. Over the last

The holding-period rate of return was 6.4 percent in 2001, down from 6.8 percent in 2000, but above the average of 5.6 percent in the years 1992–2001.

ten years the holding-period rate of return in local-currency terms came to 11.5 percent a year, and after deducting domestic price rises in that period, 4.1 percent.

The holding-period rate of return on the reserves portfolio is affected by three main factors: market developments; long-term investment decisions relating to their currency composition, duration, asset composition and its dispersion along the yield curve—these decisions are expressed in the composition of the neutral benchmark of the portfolio (as explained in Box 1.2); and decisions on deviations from the neutral benchmark (day-to-day portfolio management).

Table 1.2
The Performance of the Actual Portfolio vis-à-vis the Neutral Benchmark Portfolio,^a
1992-2001

(percent, in annual terms)

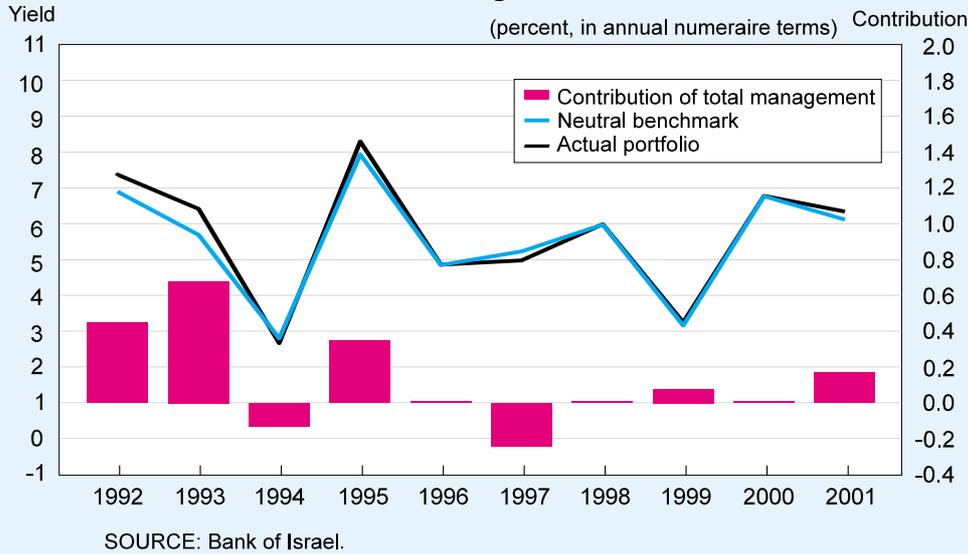
	Portfolio performance		Incremental yield							
			Currency management		Asset and duration management					
	Actual portfolio	Neutral benchmark	Total	management	Decision to invest in GNMA	Duration management	Asset and dispersion management			
							Total	Asset Management	Dispersion	
1992	7.40	6.90	0.45	0.12	0.33	–	–	–	–	–
Standard deviation	1.07	0.76	0.51	0.29	0.50					
1993	6.42	5.70	0.68	0.04	0.64	–	0.26	0.38	–	–
Standard deviation	0.89	0.55	0.42	0.21	0.43					
1994	2.68	2.81	–0.13	–0.01	–0.12	0.27	0.19	–0.57	–	–
Standard deviation	0.75	0.62	0.32	0.07	0.33					
1995	8.31	7.94	0.35	0.35	0.00	–0.10	0.26	–0.16	–	–
Standard deviation	0.56	0.56	0.24	0.10	0.21	0.05	0.19	0.10	–	–
1996	4.87	4.86	0.01	–0.01	0.02	0.03	–0.11	0.11	0.20	–0.09
Standard deviation	0.70	0.59	0.23	0.10	0.17	0.05	0.16	0.06	0.08	0.03
1997	4.99	5.24	–0.24	–0.26	0.02	0.03	–0.17	0.17	0.18	–0.01
Standard deviation	0.44	0.49	0.16	0.08	0.12	0.02	0.09	0.06	0.07	0.02
1998	6.00	5.99	0.01	0.00	0.01	–0.03	0.01	0.04	0.10	–0.07
Standard deviation	0.63	0.69	0.08	0.03	0.08	0.06	0.02	0.05	0.05	0.02
1999	3.26	3.17	0.08	0.02	0.06	0.03	–0.06	0.10	0.05	0.05
Standard deviation	0.66	0.60	0.13	0.02	0.13	0.05	0.08	0.07	–	–
2000	6.79	6.78	0.01	–0.15	0.16	–0.04	0.00	0.20	0.19	0.01
Standard deviation	0.89	0.86	0.11	0.06	0.10	0.03	0.02	0.10	–	–
2001	6.35	6.13	0.17 ^b	0.00	0.16	–0.05	–0.01	0.22	0.23	–0.01
Standard deviation	1.44	1.36	0.20	0.03	0.10	0.04	0.04	0.08	0.09	0.10
1992–2001	5.61	5.49	0.13	0.01	0.12	–	–	–	–	–
1993–2001	5.51	5.39	0.10	0.00	0.11	–	0.02	0.04	0.05	–

^a Yields in terms of the numeraire. Beginning with 2001, yields are calculated using a new computer system.

^b The differential between the yield on the actual portfolio and that on the neutral benchmark was 0.22 percent whereas management decisions reported in the Table account for 0.17 percent. The difference of 0.055 percent is not explained (see also Table 1.4).

SOURCE: Bank of Israel.

Figure 1.2
Yield and Contribution of Total Management, 1992–2001



The level of the holding-period rate of return in 2001 reflects the decline in that year in yields to maturity in the US and European capital markets. In particular, yields to maturity in the short-term sections of the curve declined, due to the expansionary monetary policy spearheaded by the US but pursued also in Europe and the UK in response to the slowdown in economic activity. The decline in yields to maturity was reflected in the rise of bond prices (see Appendix 1.1).

For given market developments, the neutral benchmark is the decisive factor in determining the holding-period rate of return on the reserves portfolio, due to the relatively small deviations of the actual portfolio from the benchmark. In 2001 the holding-period return on the benchmark came to 6.1 percent.

The composition of the neutral benchmark reflects the long-term investment strategy of the reserves. Hence, changes are not introduced very often. Nevertheless, its characteristics and its degree of appropriateness are reviewed from time to time, and several changes have been made. A relatively significant change took place in 1999, when the duration was extended from 12 months to 16 months as a result of research carried out in the Foreign Currency Department. The findings of the research were that the yield on an investment with a 16-month duration is higher over time than that on one with a 12-month duration; moreover, the probability that in any particular year the yield would be below a pre-determined threshold is very low. Concurrently with the extension of the duration of the benchmark, it was decided to extend also the maximum time to maturity of the assets included in it from three years to five years. This step prevented a situation in which the share of short assets in the new benchmark was too small.

The decline of yields to maturity in 2001 in the US and European capital markets, which was reflected in the rise of bond prices, affected the holding-period rate of return.

The neutral benchmark is decisive in determining the holding-period rate of return on the reserves portfolio; in 2001 the holding-period return on the benchmark came to 6.1 percent.

The quality of decisions regarding the composition of the benchmark can be checked only over a sufficiently long period because as stated the benchmark reflects a long-term investment strategy. Nevertheless, the changes described above were reviewed, and the results are given in Table 1.3. These show that in each of the three years since the duration was extended, the holding-period rate of return on the 16-month duration portfolio in the US dollar market and the German market was above the minimum level set.³ The cumulative yield on the benchmark with a 16-month duration consisting of assets with up to 3 years to maturity was also higher than that on the benchmark with a 12-month duration in both the dollar market and the German market. The 16-month duration benchmark comprising assets with up to 3 years to maturity, however, gave a higher yield than did the benchmark with the same duration but with assets spread more widely. Thus the greater dispersion of assets offset the additional yield provided by the longer duration.

Table 1.3
The Effect of the Change in the Neutral Duration, 1999-2001

	Holding-period rate of return of neutral benchmark			Minimum threshold ^a	Yield spread		
	12-month duration	16-month duration			Duration decision	Dispersion decision	Over minimum threshold
	Up to 3 years dispersion	Up to 3 years dispersion	Up to 5 years dispersion				
	(1)	(2)	(3)	(4)	(2)-(1)	(3)-(2)	(3)-(4)
US							
1999	3.83	3.44	3.26	2.43	-0.39	-0.18	0.83
2000	7.13	7.56	7.64	3.09	0.43	0.08	4.55
2001	6.58	7.50	6.59	2.21	0.92	-0.91	4.38
1999-2001	5.84	6.15	5.82		0.31	-0.33	
Germany							
1999	2.34	2.14	1.80	1.39	-0.20	-0.34	0.41
2000	4.34	4.49	4.62	2.06	0.15	0.13	2.56
2001	5.09	5.36	5.04	2.17	0.27	-0.32	2.87
1999-2001	3.92	3.99	3.81		0.07	-0.18	

^a 50 percent of the yield on a risk-free asset. In the dollar portfolio this asset was defined as a 3-month Treasury bill, and in the euro portfolio as the one-month LIBOR interest rate.

SOURCE: Bank of Israel and Bloomberg.

The management contribution to yield is the difference between the yield of the benchmark and that of the actual reserves portfolio due to positions vis-à-vis the benchmark. In 2001 it was 22 basis points.

Comparing the yield of the benchmark with that of the actual reserves portfolio enables an assessment of the contribution to yield made by current management of the portfolio. This comparison shows that management contributed 22 basis points to the yield on the portfolio (Tables 1.2 and 1.4, Figures 1.2 and 1.3).⁴

³ To perform the check, portfolios with 12-month and 16-month durations were constructed with different asset dispersions, according to principles similar to those used to build the neutral benchmark portfolio. For simplicity, assets on the German market were taken as representing the benchmark assets of the euro portfolio, although the latter incorporates assets issued by other countries too.

⁴ Unlike the benchmark yield, the yield on the portfolio is affected also by transaction costs, which reduce the difference between the two yields.

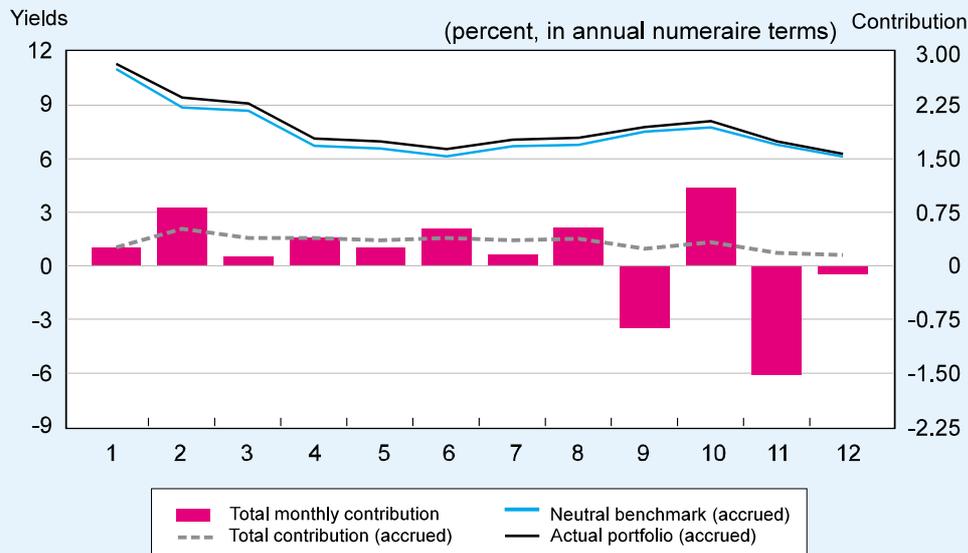
Table 1.4
Contribution of Management Decisions to the Yield Spread
vis-à-vis the Neutral Benchmark, 2001

(basis points, in annual terms)

	Total contribution	Investment in the GNMA sector	Duration	Asset Selection	Dispersion along curve	Currency	Unexplained difference
Total^a	22.0	-1.2	-4.5	22.6	-0.8	0.4	5.5
Currency portfolios,							
Total	16.1	-1.2	-4.5	22.6	-0.8		
Dollar portfolio	12.6	-1.6	-4.5	19.0	-0.3		
Euro portfolio	2.4	-0.8		3.9	-0.6		
Other portfolios	1.1	1.2		-0.3	0.1		
Currency positions	0.4					0.4	
Unexplained difference	5.5						5.5

^a The total contribution equals the total of the contributions from the different decisions and from the different portfolios for each month. In switching to an annual calculation differences between them may be introduced.
 SOURCE: Bank of Israel.

Figure 1.3
Accrued Yields on the Total Actual Portfolio and the Neutral Benchmark
Portfolio, and Monthly and Accrued Management Contribution, 2001



SOURCE: Bank of Israel.

b. The management and contribution of risk factors

In the course of regular management of the portfolio, decisions are taken regarding the portfolio's currency composition and duration, the assets included in it, and their

distribution along the yield curve. In each of these features, the portfolio can either match the neutral benchmark or deviate from it, within the permitted degrees of freedom. A deviation from the benchmark composition (a position) means a difference in yield from that of the benchmark, together with an increase in risk. In position management it is customary to impose a maximum potential loss. The position is closed if the cumulative loss on it reaches the limit. In the last few years the main effort in the ongoing management of the portfolio has focused on asset selection, and the contribution of this aspect does indeed form an important part of the total contribution of active management. A description of the contribution of the main investment decisions follows.

Currency position management made only a small contribution to incremental yield in 2001.

Small currency positions were managed based on models and tactical considerations.

i. *Currency management*

Decisions in the field of currency management determine the difference between the currency composition of the portfolio and that of the numeraire. This gap is called the currency position. The currency management contribution, which includes cross-rate differentials, interest, and capital gains on the currency positions, was close to zero in 2001 (about half a basis point).

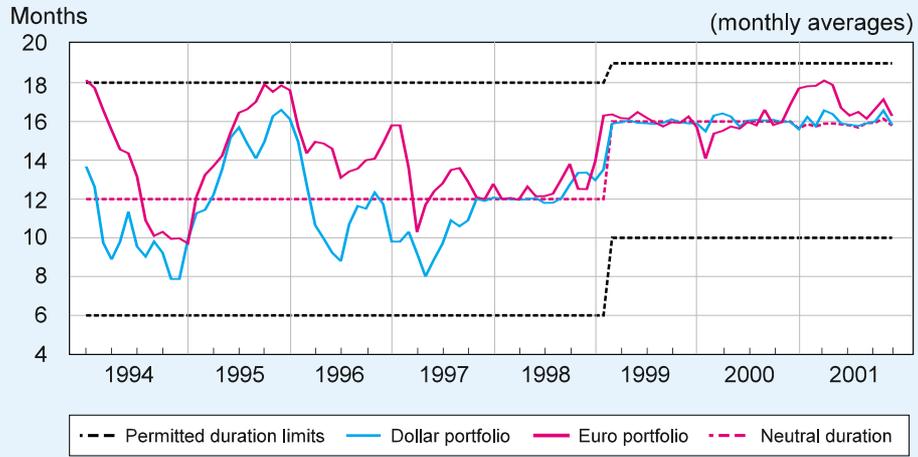
As it has proved very difficult to profit from currency positions which are based on forecasts of exchange-rate trends according to economic and political developments, the department decided to try to base these positions on technical models. In the middle of 2000 the department started using three models which aid the management of short-term foreign currency positions. The sum invested according to the recommendation of each of the three models is fixed and relatively small. A trial period was decided on, but if accrued losses before the end of the trial period were to reach the ceiling which has been set, the experiment would be cut short. After a few months of activity guided by the recommendations of the models, it transpired that the performance of two of them was lower than expected, and they were therefore replaced by another model in the first months of 2001. Since the beginning of the trial many positions, held for different periods of time, have been managed. The profit-and-loss of this activity is relatively highly volatile. During 2001 the positions yielded a small profit of about one basis point on the whole of the reserves portfolio. In addition to these currency positions, some other individual currency positions were managed in the course of the year based on tactical considerations. The losses incurred through these positions offset part of the profit earned on the positions managed according to the models.

ii. *Duration management*

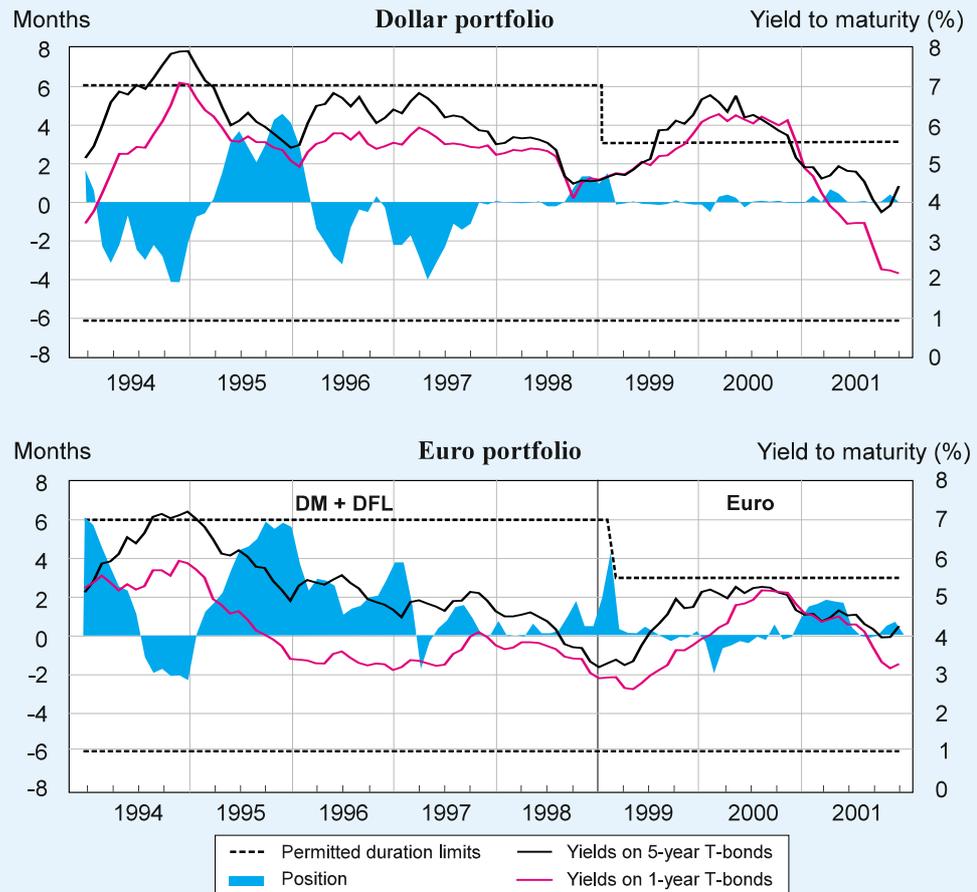
Duration position management contributed a negative incremental yield of one basis point in 2001.

Duration positions are those taken by choosing a duration different from the neutral duration of the reserves portfolio, which is 16 months for all the currency portfolios. The size of the duration positions in the currency portfolios has contracted significantly in the last few years; in 2001 these positions in the currency portfolios were very small, and they contributed a negative incremental yield of about one basis point vis-à-vis the benchmark (Box 1.2 and Figure 1.4).

Figure 1.4
a. Duration of Main Currency Portfolios, 1994–2001



b. Duration Positions in Various Currency Portfolios, and Yields to Maturity in Bond Markets, 1994–2001



SOURCE: Bank of Israel.

The duration of the dollar portfolio was slightly above neutral in the first part and at the end of the year. Duration management of this portfolio resulted in a 2-basis-points loss of yield on the reserves portfolio in 2001.

The duration management of the *dollar portfolio* resulted in a 2-basis-points loss of yield on the reserves portfolio in 2001. The duration of the portfolio was slightly above neutral in the first few months of the year (lengthening of the position), close to neutral in mid-year, and slightly above neutral again at the end of the year.

Underlying the lengthening of the dollar portfolio at the beginning of the year was the assessment that the slowdown in the US economy, with sharp falls in the stock market, would prompt the Fed to continue with the expansionary policy it introduced in January 2001. The lengthening of the portfolio at the end of the year was based on the view that the US economy was not expected to recover in the next few months.

As it became clear in the course of the year that the slowdown in the US was more severe than had been assessed, and with the further deterioration in the wake of the terrorist attacks on the World Trade Center and the Pentagon in September, the Fed undertook a series of interest-rate reductions which came to a cumulative 4.75 percentage points, from 6.5 percent at the beginning of the year to 1.75 percent at the year-end. In response to economic developments, yield to maturity on Treasuries declined from January to October, while the yield curve steepened considerably and yields became far more volatile. The steepening of the curve occurred mainly due to the marked reduction of the short-term interest rate by the Fed. The actual drop in the yield to maturity in the first months of the year was greater than that discounted by the yield curve at the beginning of the year. As a result, the long position in the dollar portfolio at that time provided incremental yield vis-à-vis the benchmark.

During the last months of the year the yields to maturity for assets with more than two years to maturity increased, as investors considered that a recovery in the US was closer than had been assessed. The rise in yields in this period may also have been due to concern that the expansionary fiscal policy would lead to future deficits in the US budget following several years of surpluses. This was the background to the loss in yield on long positions at that time, which more than offset the profit from duration management in the first months of the year. The fall in yields to maturity in the longer-term part of the yield curve was accompanied by a narrowing of the spread between the yield to maturity on US Treasuries and that on assets issued by other entities (spread assets). The spreads widened in the immediate aftermath of the terrorist attacks in the US, but contracted again soon after. These spreads had been widening since 1998, apparently due to the internalization and improved pricing of the financial risks inherent in spread assets. The trend towards narrower spreads which started in the last months of 2000 can be explained by several factors, including investors' expectations that the US budget surplus would become a deficit in the next few years, and the change in the issuance policy of the US Treasury in favor of issues with shorter periods to maturity, which led to a contraction of the spreads in the short end of the yield curve. This development made issuers who would normally have raised short-term capital change their approach and raise long-term capital, performing swap transactions between long-term and short-term interest payments. This caused the spreads to contract at the long end of the curve. Other reasons for the contraction of the spreads included investors

incurring greater risks by increasing their investments in spread assets to earn incremental yield, and hedging activity by the managers of mortgage-backed security portfolios.

The contribution of duration management of the *euro portfolio* was a negative one basis point. In the first half of the year the duration was above neutral, in the third quarter it was neutral, and in the last quarter it was above neutral again. The loss on the long position in the portfolio derived from a higher rise in the yield in the second quarter than that discounted by the yield curve. The loss was only partly offset by the profit on the duration position in the other months of the year.

The long position in the portfolio was opened on the basis of the assessment that growth in Europe had slowed, and that it would slow further as a result of the global recession. The view was taken that such a development, together with the decline in fuel prices from their peak level in the third quarter of 2000, would allay fears of an acceleration in the rate of price increases, and would probably spur the ECB to adopt an expansionary policy and reduce interest rates.

Such a policy was indeed adopted, but the first cut in the interest rate by the ECB in 2001, 0.25 of a percentage point, did not take place until May. In the next few months the ECB implemented further reductions, which over the whole amounted to a total of 1.5 percentage points, bringing the rate at the end of the year to 3.25 percent.

The contribution of duration management in *other currency portfolios* came to one basis point. Their duration was above neutral throughout the year, a position which provided an incremental yield as yield to maturity declined.

In the first half of the year and at the end of the year the duration of the euro portfolio was above neutral. In 2001 the contribution of duration management of this portfolio was a negative one basis point.

The contribution of duration management in other currency portfolios came to one basis point.

iii. *The strategic decision to invest in the GNMA sector*

Several years ago the Department decided to invest a certain part of the dollar portfolio in GNMA mortgage-backed securities. This decision, assessed as the difference between the GNMA market index and the yield on Treasuries with maturities of between one and five years,⁵ made a negative contribution of 4.5 basis points in 2001. There were two reasons for the negative contribution:

The strategic decision to invest in the GNMA sector made a negative contribution of 4.5 basis points in 2001.

The first was the widening of spreads between yields to maturity on GNMA's and those on Treasuries, as yields to maturity in the Treasury market declined. Falling yields make early repayment of mortgages more worthwhile, as a result of which the cost of the implied option rose. This cost forms part of the yield spread between GNMA's and Treasuries. The rest of the yield spread (the option adjusted spread, or OAS) narrowed during the year, as did the yield spreads in other spread assets, described above. This development, however, offset only part of the marked rise in the cost of the option during the year (Figure A1.1.4 in Appendix 1.1).

The second reason was steepening of the yield curve, which led to the better performance of Treasuries with between one year and five years to maturity than that of more widely dispersed combinations of Treasuries with the same duration. A comparison of the GNMA market index and the yield on Treasuries with maturities of between one and five years thus does not favor the former.

⁵ The comparison is made after adjusting for the duration gap between the GNMA market index and these Treasuries.

Box 1.4: Spread Assets in the Reserves Portfolio

Spread assets feature in the financial markets of all advanced countries. A spread asset is a debt instrument whose yield to maturity comprises the yield on another asset such as a government security, plus an additional yield spread. The spread generally changes continuously and moderately in accordance with changes in the demand for and supply of the relevant type of assets. The extra yield compensates the investor for the shortcomings of the spread asset relative to the basis asset, such as additional credit risk or a less liquid secondary market.

The Bank of Israel's approach to spread assets in the investment policy of the foreign exchange reserves derives from the Bank of Israel Law and the relevant legal interpretations of it. These permit the Bank to invest in debt instruments fully guaranteed by a sovereign government, in bank deposits, and in similar instruments (CDs, etc; see Box 1.2). Decisions taken within the Bank restrict even further the range of assets in which it can invest, for instance by determining a minimum credit rating for the issuer, by investing only in countries with suitable financial robustness (those with a 'country quota'), and by investing only in currencies considered 'reserve currencies.' Thus the Bank can invest only in certain types of spread assets. The most important of the permitted types are bank deposits, government bonds issued in the currency of another country, such as Eurobonds, debt instruments of international financial institutions such as the World Bank and the BIS, etc.

A certain inconsistency seems to arise from the restrictions imposed by the law, as the Bank is permitted to invest in government bonds whose credit risk, as measured by their credit rating and reflected by their yield spread, is higher than that of other spread assets in which it may not invest. Spread assets in which the Bank may not invest include bonds of federal US agencies, fully collateralized debt instruments (e.g. German *pfandbriefe* and US asset-backed securities), and corporate bonds of companies with an AAA rating. The Bank's additional internal decisions reduce the inconsistency to some extent, but it still exists.

The question arises whether spread assets in which the Bank of Israel may invest should be represented in the benchmark of the reserves. The Bank's current approach is that the benchmark reflects its long-term investment strategy, i.e., the strategy it would adopt if it were unable to practice active management of the reserves. The long-term investment strategy reflects the Bank's order of priorities (and the legal restrictions on investing the reserves). As a result of the need to maintain a high level of liquidity of the reserves and also protect their real value, the benchmark does not include spread assets, as in times of crisis such assets are likely to incur significant capital losses. Whereas the development of such conditions may be predictable to some extent in the short term, this is not the case in the long term. Another reason for the exclusion of spread assets from the benchmark is the lack of a continuous supply of them. The conclusion to be drawn is that as part of active management, spread assets are appropriate

for opening positions, even of a large size and on a frequent basis, but they are not suitable for inclusion in a passively managed portfolio, the style of management meant to be appropriate for a benchmark.

A counter argument may be put forward, that if in practice a type of asset forms a constant part of the reserves portfolio, the decision to invest in it is not part of day-to-day active management of the portfolio, but is a long-term strategic decision which should therefore be reflected in the composition of the benchmark. Moreover, the inclusion of such an asset in the benchmark would present a challenge to the portfolio managers, and spur them to find new sources to provide incremental yield. In contrast to the first approach, according to which the crucial consideration in selecting the benchmark is minimizing risk, this approach makes the achievement of a higher yield the prime objective. Although the Bank of Israel has customarily adopted the first approach, the Foreign Currency Department intends to undertake a thorough re-examination of the appropriate approach to constructing the benchmark for the reserves portfolio.

iv. *Asset selection*

The profit from asset selection is the contribution of the decision to invest in assets which are not included in the benchmark portfolio. It is measured by the difference between the holding-period rate of return on those securities and that on the assets with similar durations included in the benchmark, taking their share in the portfolio into account. Among the assets not included in the benchmark portfolio are bank deposits, tradable certificates of deposit (CDs), commercial paper (CP), floating-rate notes (FRNs) and Eurobonds, CPI-indexed bonds (Treasury Inflation-Protected Securities—TIPS), mortgage-backed securities (GNMAs), and repo and reverse-repo transactions. (See Box 1.4 for a discussion of the inclusion of spread assets in the reserves portfolio and in the benchmark.) As mentioned above, active portfolio management in recent years has focused to a great extent on asset selection. In 2001 these decisions contributed 23 basis points to the yield on the portfolio. The major contribution came from the dollar portfolio, the largest currency portfolio, with a smaller positive contribution being made by the euro portfolio (Table 1.5 and Figure 1.5). The incremental yield deriving from the investment in spread assets entailed a relatively small increase in spread risk, as expressed in terms of Value-at-Risk (VaR) (see section 5c).

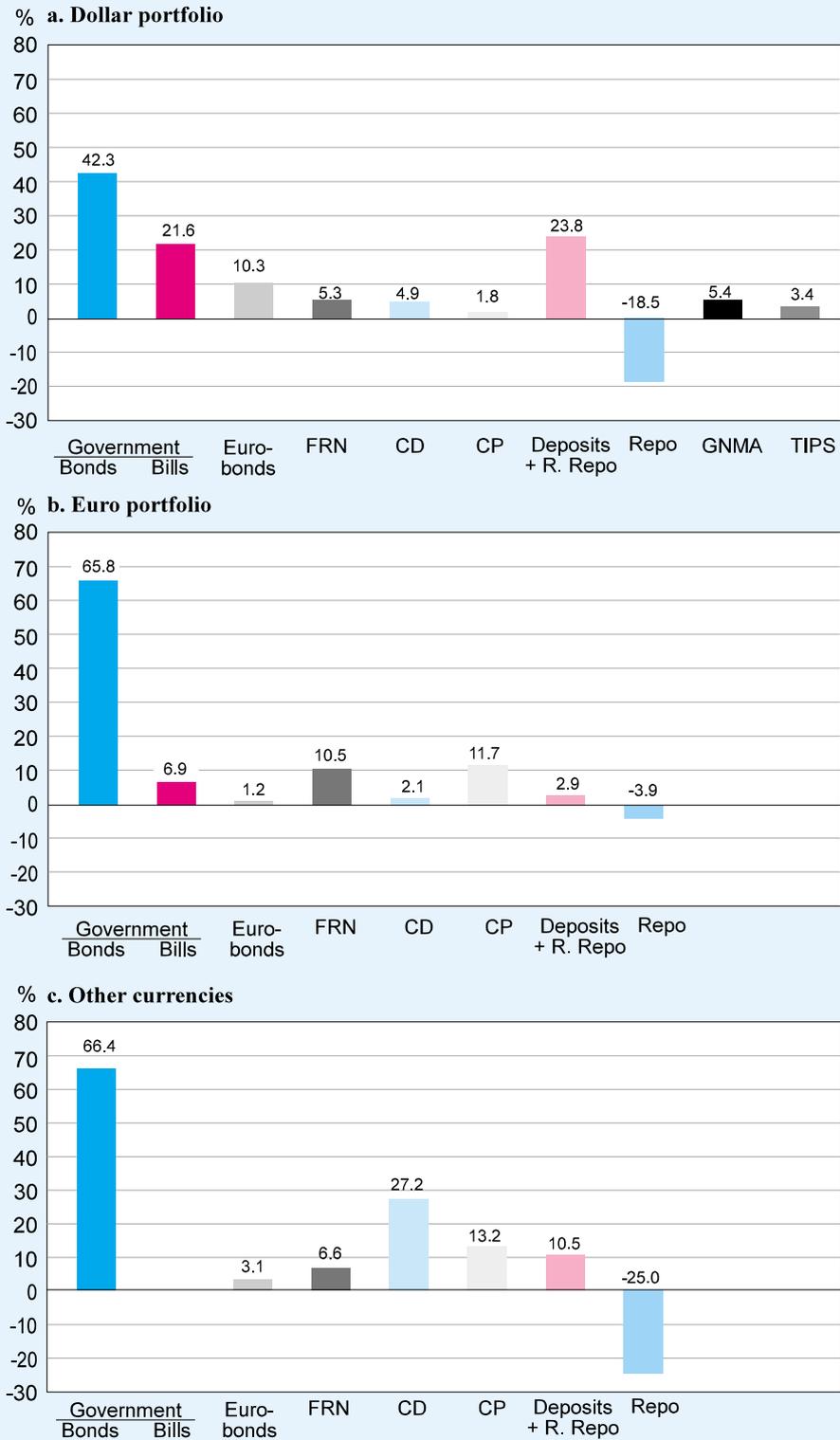
The profit from asset selection in the dollar portfolio in 2001 was 19 basis points. A significant part of this contribution, 7 basis points, derived from investment in TIPS. The incremental yield on this investment came from securities with 6 to 8 years to maturity which were bought in the last few months of 2000 and held during the first half of 2001.

The expansionary policy pursued by the Fed from the beginning of 2001 and expectations of additional expansionary measures, together with the assessment that the effect of the rise in energy prices had not yet been fully felt, were expressed by a marked rise in the price of TIPS. In the last few months of the year there was renewed

Asset-selection decisions contributed 23 basis points to the yield differential in 2001, offsetting losses resulting from other decisions.

The major contribution came from asset-selection in the dollar portfolio, especially the investment in TIPS and Eurobonds, and security-lending activity.

Figure 1.5
Average Asset Distribution of Currency Portfolios, 2001



SOURCE: Bank of Israel.

Table 1.5
The Contribution of Asset Selection

(basis points, in annual terms)

	Portfolio			Total
	US\$	€	Other	
Deposits, and reverse repo	-2.6	0.2	0.1	-2.3
Repo	5.9	0.1	0.2	6.1
<i>of which; Securities lending by the</i>				
Foreign Currency Department	4.3			4.3
Securities lending for the Bank of				
Israel		0.4		0.4
Tradable certificates of deposit	0.9	0.3	-0.3	0.9
Commercial paper	0.3	1.0	0.2	1.5
Floating-rate notes	1.1	2.2	-0.3	2.9
Eurobonds	5.4			5.4
Synthetic trades	1.1	0.1		1.2
Short-term government securities		-0.4		-0.4
TIPS	7.0			7.0
GNMA	0.1			0.1
<i>of which;</i>				
Tactical position	-1.0			
Portfolio management	1.1			
Total ^a	19.0	3.9	-0.3	22.6

^a Differences may arise due to the rounding of figures.

SOURCE: Bank of Israel.

investment in TIPS, in a security maturing in the near future. This investment resulted in a loss of yield vis-à-vis the benchmark, mainly because the rise in prices was slower than expected (see Box 1.5 for a discussion of TIPS.)

Box 1.5: US Treasury Inflation-Protected Securities (TIPS)

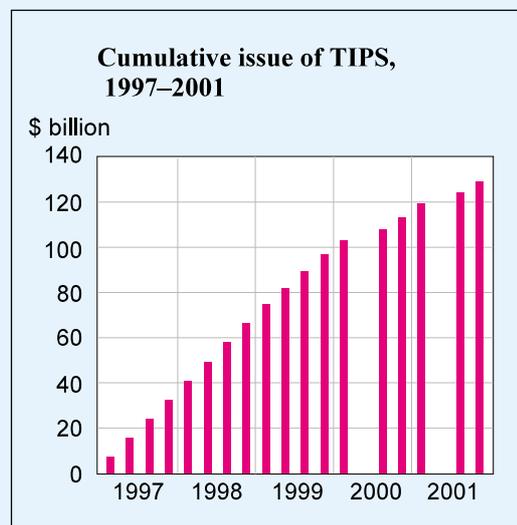
The US government first issued TIPS in January 1997; in so doing, it joined the group of established industrialized countries which had issued CPI-indexed bonds in the previous ten years, including Canada, France, Sweden and the UK. This box describes the background to the introduction of the TIPS and how the market for them developed in its first five years.

Indexed bonds, government or private, are issued in some thirty countries, including Israel. In many of them the prime motive in issuing these bonds was the relatively high premium required to compensate for inflation risk, after a tradition of price stability had been undermined, making it difficult to issue long-term unindexed bonds with a reasonable yield. Some countries continued to issue indexed bonds even after inflation had declined and had remained stable at a low rate for several years, and the inflation-risk premium had shrunk, because this financial instrument had established itself as an important part of the domestic capital market.

In contrast to the situation outlined above, in other countries, including the US, the decision to issue indexed bonds was taken at a time of low long-term

inflation expectations. One of the main considerations underlying the decision in these cases may have been the desire to use the yield spread between indexed and unindexed bonds as an indicator of the public's inflation expectations. Various macroeconomic models are based *inter alia* on inflation expectations, and there are grounds for claiming that expectations derived from the capital market are more reliable than those from other sources (surveys, etc.). Additional reasons for issuing indexed bonds include: it bolsters the public's confidence that the policy of price stability will continue (as if it does not, the government itself will suffer too); it creates a benchmark issue for the issue of CPI-indexed issues by the private sector; and it lowers the cost of government borrowing by widening the range of debt instruments on the market.

The cumulative nominal value of TIPS reached \$ 130 billion at the end of 2001 (see figure), about 5 percent of the nominal balance of all (long-term and short-term) US Treasuries. In the past TIPS were issued for periods of 5, 10 and 30 years. About 55 percent were for 10 years, 32 percent for 30 years, and 13 percent for 5 years; plans for the future call for the issue of 10-year TIPS only. The rate of issues has slowed in the last two years due to the tendency of the US Department of the Treasury to reduce issues, in the light of the accumulation of surpluses in the federal budget. Demand for TIPS is lower than that for 'normal' Treasuries for tax and other reasons. In order to ensure a sufficiently high degree of liquidity in each series, the Treasury would issue a relatively large share (about 50 percent) by re-opening existing series. Until the beginning of 2001 the yield on 10-year TIPS was between 3.5 percent and 4.5 percent, but it declined in 2001.



The contribution of asset selection includes that derived from *securities-lending activity* by the Foreign Currency Department. This activity, which started in mid-1999, is performed mainly in dollar securities. The activity consists of linking a pair of transactions—a repo trade with a reverse-repo trade or a bank deposit. In the repo transaction a security is lent. The cash received is 'deposited' in a reverse-repo transaction against another security, or is invested in a bank deposit. The two transactions are for the same period, and have no effect on the duration of the portfolio. The profit from such a pair of transactions arises from the fact that the securities which are lent in the repo transaction are in demand in the market by parties who are prepared to borrow

them and to lend the equivalent value in money to the securities lender at a lower rate of interest than they could receive by depositing it elsewhere.

Income from securities lending in 2001 totaled \$ 10 million, about 4 basis points on the total reserves portfolio. In most of these transactions in 2001, the money received in the repo was invested in bank deposits; as a result, this activity made great use of the ceiling on the exposure of the reserves to the banking system. As the investment horizon in lending transactions is very short, so too is the period of exposure to the banking system.

Investment in Eurobonds and FRNs made a positive contribution of about 5 basis points and 1 basis point respectively. The better performance of these securities derived from their positive spreads vis-à-vis Treasuries, and from the contraction of the spreads described above.

Investment in CDs in the dollar portfolio contributed 1 basis point to the yield of the total portfolio. This investment was reduced during the year because of the great contraction of the TED spread which made such investment less worthwhile.

*Synthetic transactions*⁶ also provided an incremental yield, of 1 basis point, to the yield spread vis-à-vis the benchmark. The balance of investments in them was reduced due to the reduction in their profitability.

Investment in GNMA's made only a marginal contribution to yield. The contribution is made up of two components:

- ♦ The first is the contribution from management of the GNMA portfolio compared with a benchmark which serves as an index of the GNMA market. This component provided a positive 1 basis point to the yield on the portfolio. Most of the GNMA portfolio is managed by the Foreign Currency Department, and a small part by an external portfolio manager (see Box 1.6 for a discussion of the use of external managers in the management of the foreign exchange reserves.)
- ♦ The second is the position in GNMA. The investment in GNMA's in 2001 was higher than that set in the Department's strategic decision mentioned above. The contribution of this investment is measured by the yield spread between it and the yield on Treasuries of between one year and five years to maturity. This position contributed a negative 1 basis point to the yield of the portfolio for the same reasons as the strategic decision to invest in the mortgage sector also made a negative contribution.

Asset selection in the *euro portfolio* made a positive contribution of 4 basis points to the total yield, and derived mainly from investment in FRNs and commercial paper.

In addition to securities-lending activity by the Foreign Currency Department described above, two financial institutions which hold the Bank's securities in the foreign exchange reserves portfolio in custody also lend some of these securities on behalf of the Bank. This activity is performed using securities denominated in euro and in other currencies (excluding US Treasuries). The risk in lending is very low, and this activity does not harm the Bank's current activity in the securities which have been lent. Income from lending by the two institutions in 2001 amounted to about \$ 1 million, about half a basis point.

⁶ See Appendix 1.2 for a definition

Box 1.6: The Use of External Managers to Manage Central Banks' Foreign Exchange Reserves

Until about ten years ago the use of the services of external managers by central banks and international financial institutions was shrouded in secrecy. Since then information related to the external management of reserves has grown and become more readily available, apparently reflecting an increase in such activity as well as the tendency of central banks towards greater transparency. Despite this trend, central banks are still hesitant to allocate part of their reserves to externally managed portfolios or to reveal information about such activity. A search through the websites of the central banks of several industrialized countries and supranational financial institutions revealed four which publish information on the use of external managers—the central banks of the Czech Republic, Hong Kong, and Norway, and the European Bank for Reconstruction and Development (EBRD).

As far as is known, no central bank of any industrialized country hands the management of all or even a large part of its foreign exchange reserves to external managers. There are two main reasons: firstly, some of the functions of reserves management, mainly liquidity management and the supply of liquidity to the government, management of the currency composition, and intervention when necessary, can only be performed by the central bank itself, so that external management can at best complement the central bank's internal management of the reserves, but cannot replace it. Secondly, even the use of entirely external management would not absolve the central bank from the management effort involved in holding the reserves, as it must constantly follow up on the manager, assess the management performance, and develop the expertise needed to do so. Several possible reasons for choosing external management are listed below:

- ◆ It can provide access to expertise in a specific complex field. Developing the ability to manage this field within the central bank may not be possible, or it may be too expensive if the planned investment is only a small part of the total reserves. In such a case, the external portfolio would be invested in assets which are not part of the internal portfolio.
- ◆ It can allow the central bank to benefit from specialized knowledge or sophisticated methods available to the external manager due to his large share in that market, his activity in other markets, or his geographical location, etc. However, according to the theory of market efficiency, such advantages, if they exist, should be offset by the management fees charged by the external manager.
- ◆ It enables active management to be dispersed among several managers, with the intention of reducing the volatility of the management contribution, provided the expected active management contribution does not decline as a result.

- ◆ It provides another yardstick by which to measure the performance of the internal management of the portfolio and creates an incentive to improve the yield. To do this the portfolio of the external manager must be the same as the internal one, or at least the same as a certain part of it, in its benchmark and its allowed degrees of freedom. Nevertheless, without supplying the internal manager with additional resources and easing various organizational constraints, it is doubtful whether such ‘competition’ will have a positive effect on the performance of the internal portfolio.
- ◆ It can solve certain technical problems such as geographical distance or time differences. External management could also be part of an emergency operation strategy.
- ◆ External managers can offer related services such as consultation and training for the internal managers. However, such services can usually be obtained more efficiently by other means.

Apart from the direct cost of management fees, the use of external managers entails other problems which develop very quickly as the number of managers increases or as the amounts they handle grow. These problems may include the need for self-protection against fraud and abuse; constructing and maintaining appropriate follow-up and control mechanisms; and managing the relations between the central bank and the external managers. As a result of such considerations the Bank of Israel has hitherto used external management of the reserves to only a very modest degree.

v. *The dispersion of assets along the curve*

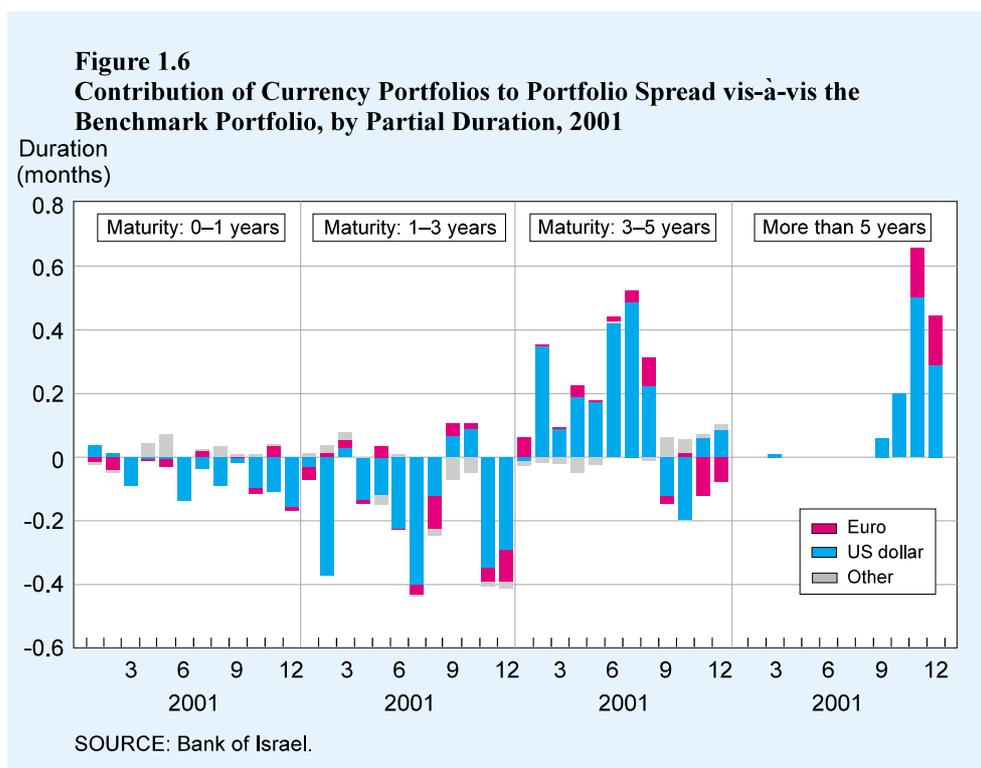
The dispersion of the reserves portfolio by period to maturity of the assets differed only slightly from that of the benchmark. This becomes evident when one looks at the dispersion of the duration over the different parts of the yield curve (the ‘partial duration’)⁷ compared with that of the duration of the benchmark (Figure 1.6).

Figure 1.6 shows that the portfolio was less sensitive than the benchmark to changes in the yield curve up to three years to maturity, and more sensitive in the section of more than three years to maturity.

The contribution of the dispersion compared to the benchmark was negative and small, only one basis point. By far the greatest part of the dispersion compared with the benchmark derived from that of the *dollar portfolio*, due to its large weighting in the total reserves portfolio. The dispersion position in the dollar portfolio is to some extent the outcome of investment in spread assets, particularly in long-term bonds like Eurobonds. Furthermore, during the year several dispersal positions were opened based on the assumption that the curve would flatten. The small loss incurred on the dollar portfolio resulted from the fact that the slope of the actual yield curve was steeper than that predicted by the implied yield curve in most months of the year.

The dispersion in the dollar portfolio is partly due to investment in spread assets. In 2001 the dispersion contributed a negative one basis point.

⁷ See Appendix 1.2 for a definition



Positions were opened in the *euro portfolio* mainly in the last months of the year, based on the assumption that the curve would flatten. As in the dollar portfolio, these positions made a small negative contribution because the slope of the actual yield curve was steeper than that predicted by the implied yield curve.

c. The yield on the reserves portfolio compared to that achieved by other managers

Comparing the performances of different portfolios is problematic, firstly because they are generally managed against different benchmarks, and secondly because of the different management policies applicable. Nonetheless, something can be learned from a comparison of similar portfolios.

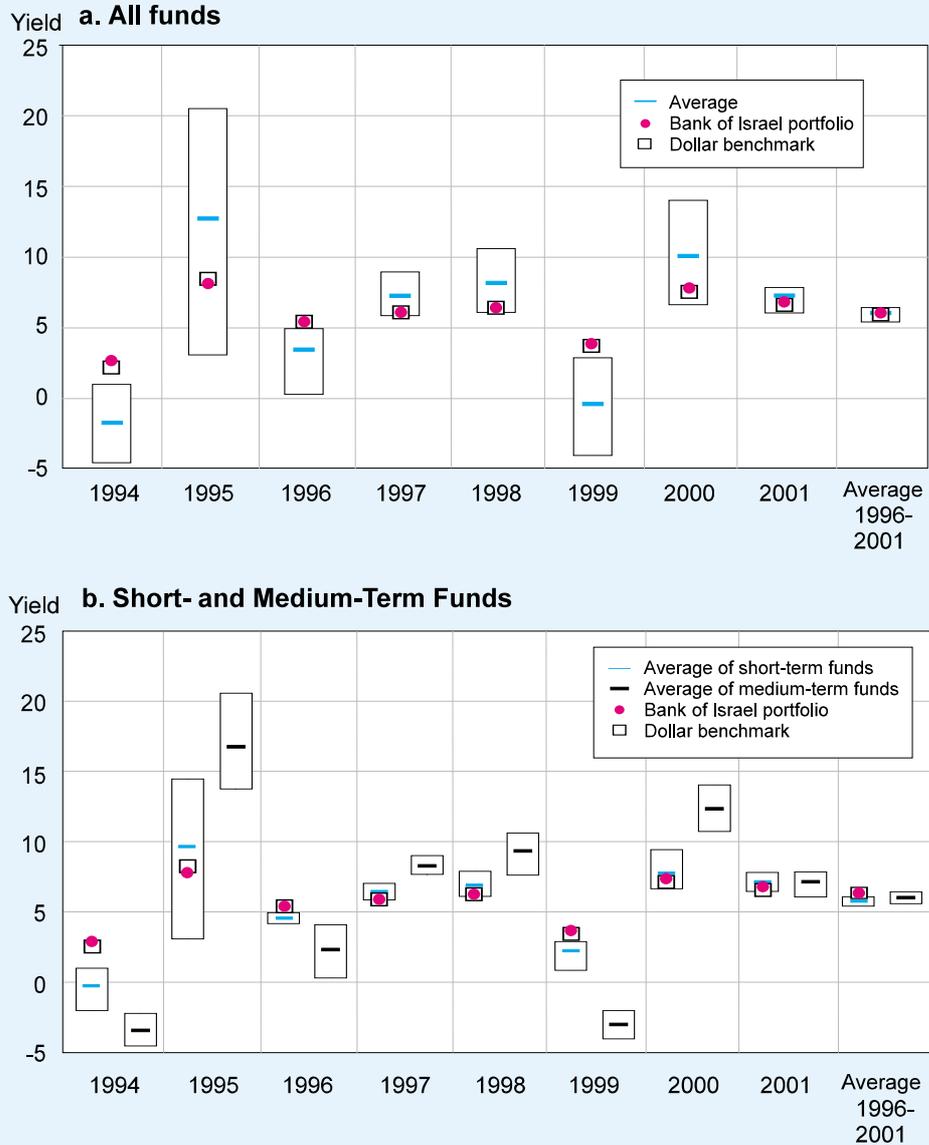
Data are available relating to the performance of several funds which operated in the US market from 1994 to 2001.⁸ The group consists of ten funds which invest mainly in US government bonds. Some are classified as ‘Investors in short Treasuries,’ and the others as ‘Investors in medium Treasuries.’ The funds do not specialize in TIPS, and invest only a small amount in assets with ratings lower than AA. These features enable the performance of the Bank of Israel’s dollar portfolio to be compared with that of the funds, despite the differences between them.

Figure 1.7a shows the distribution since 1994 of the annual holding-period rates of return of the funds in the group, as well as the yield distributions of each of the sub-groups (i.e., those investing in short-term Treasuries and those in medium-term)

⁸ The data were obtained from Lipper Inc., the *Wall Street Journal*’s website, and Bloomberg.

Figure 1.7
Performance Distribution of Managers of Short- and Medium-Term Funds
in US Market, 1994–2001

(percent, in annual terms)



SOURCE: Lipper Inc., Wall Street Journal, Bloomberg, and Bank of Israel calculations.

(Figure 1.7b). For each period the lowest, average, and highest yield of the portfolios in the group are shown. The performances of the Bank of Israel’s dollar portfolio and that of the dollar benchmark are also shown in the relevant periods.

The results show that throughout the period the performance of the Bank’s dollar portfolio was within or higher than the range of distribution of the funds’ performance.

The yield on the dollar portfolio in the last few years was within or higher than the range of yields achieved by other comparable portfolios.

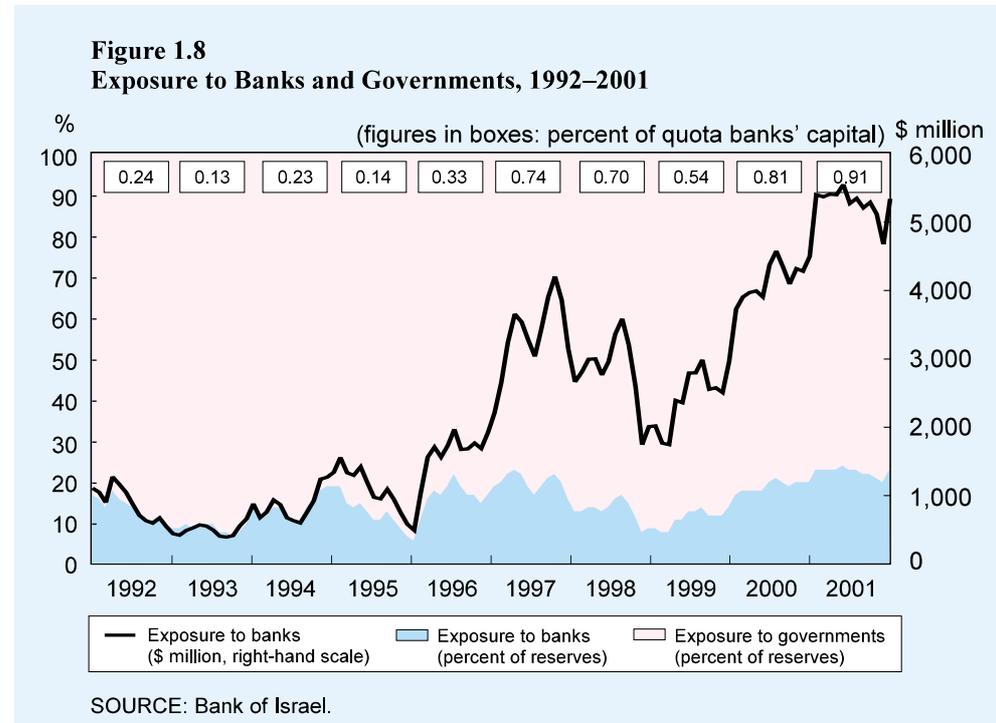
In the years when the dollar portfolio out-performed the funds (in 1994, 1996 and 1999), the yield to maturity in the US Treasuries market rose, and the performance of the short funds exceeded that of the medium ones. The better performance of the dollar portfolio at these times suggests that it has a shorter duration than those of the other funds, which would also explain its relatively low position among the holding-period rates of return in the years when the yield to maturity declined.

The dispersion of funds' yields shows the broad range of the composition of their investments and the greater yield volatility of the medium ones than of the short ones due *inter alia* to the longer duration of the latter. All the funds in the group had negative yields in 1994 and 1999. Nevertheless, the range of cumulative yields of the funds in each group is very narrow, and is similar to the range in the other group.⁹ It would thus appear that the profit derived from the incremental risk incurred by the medium funds is relatively small. The performance of the dollar portfolio is very close to that of the dollar benchmark, due to the relatively small size of positions opened in it.

3. EXPOSURE OF THE RESERVES TO THE BANKING SYSTEM

The exposure of the reserves to the banking system is relatively low, and is limited by a maximum permitted level. In 2001, on average, it was higher than in 1999 and 2000.

The exposure of the foreign exchange reserves to the banking system is an important part of the exposure of the portfolio to credit risk (Box 1.7). In 2001 the average exposure of reserves to the banking system, 23 percent of the reserves, was higher than in 2000 and 1999, when it was 19 percent and 13 percent respectively (Figure 1.8). With the



⁹ The cumulative yield is calculated for the period from 1996 to 2001, because no information relating to two funds for 1994 and 1995 is available.

rise in the exposure to the banking system, there was also a small increase in the exposure to the capital of banks in which the Bank invests, although this rate of exposure (shown in Figure 8 as the numbers in the boxes) was very low. The rise in the exposure to the banking system in 2001 was made possible by the increase in November 2000 in the maximum permitted exposure to 25 percent (Box 1.2).

The high degree of utilization of the maximum in 2001 derived from dollar-securities lending, as stated above. Due to the very short horizon of this activity, the banking exposure it entails is also for very short terms. (The period of every investment of reserves in the banking system is limited.) After several months at the beginning of the year when exposure to the banking system was stable, it declined to some extent later in the year, the result of a marked contraction of the TED spread in the dollar market (see Appendix 1.1).

The high degree of utilization of the maximum in 2001 derived largely from securities lending activity.

Box 1.7: Credit-risk Management of the Reserves Portfolio

Credit risk is the exposure to the possibility of a loss arising from a default on a debt. A loss deriving from a fall in price of a debt instrument due to a change in the probability ascribed by those operating in the market to such a default is also considered the realization of credit risk. The failure to pay may be that of the issuer of the debt instrument vis-à-vis his creditors or of a financial institution vis-à-vis its customers. Nonpayment of external debts by an economy is considered a default of that country.

The sensitivity of central banks, the Bank of Israel among them, to credit risk is higher than their sensitivity to other risks such as interest-rate risk. This is primarily due to the assessment that the ability to use diversification to prevent significant losses (relative to the size of the portfolio) is more limited in the case of credit risk than in other risks. Other reasons for the great caution exercised with regard to credit risk include the 'optional' nature of the risk, i.e., possibility of avoiding it altogether; the possibility that there is a connection between the realization of credit risk in a portfolio and the need to use the reserves (for example, in the case of a worldwide financial crisis); the limitations of the available tools for quantifying credit risk; the desire to avoid a situation in which the central bank must seek legal redress in the courts of another country. The fact that the realization of a credit risk affects the principal and not only profits provides an additional, behavioral motive for great caution in its management. The Bank of Israel's approach to the management of credit risk derives in part from the Bank of Israel Law and from the associated legal interpretations, as do the other aspects of its investment policy, and in part from decisions taken within the Bank which are based on standards accepted throughout the international financial community (see Box 1.2). In this context it is appropriate to mention the vigorous activity of the Bank for International Settlements (BIS) over the last ten years to heighten the worldwide banking community's awareness of the importance of proper treatment of credit risk; the BIS is spearheading a process

of formulating proper credit risk management tools and implementing them.

The Bank's approach to credit risk and the tools it uses to control it vary between different types of assets or transactions and according to the relevant variables: the risk level, generally estimated by means of credit ratings determined by the major rating firms; the period of the exposure, which can vary from one day to several years; the resilience attributed to the type of entity to which the Bank is exposed, e.g., an investment bank, a commercial bank, a clearing house, an international organization, or a country.

The investment process exposes the foreign exchange reserves to the credit risk of entities of different types. Investment in government securities exposes the reserves to the risk of the issuing country. On the other hand, investment of the reserves in bank deposits, and time lags in the settlement process and transactions whose settlement date is in the relatively distant future, such as forward transactions, currency swaps, repo and reverse repo, expose the reserves to the risk of the private entities and also to that of the countries in which those entities operate. The higher the level of a risk, the longer the period of exposure, and the less resilient the type of entity involved (e.g., banks compared to countries), the lower the Bank's willingness to be exposed to the risk.

The Bank of Israel uses a variety of instruments in the risk management of its reserves, and these reflect its implementation of three main systems: (1) avoidance of the risk, i.e., prohibiting a specific exposure, reducing it to almost zero or transferring it to an entity with a lower risk (via guarantees, etc); (2) restricting the risk, by imposing quantitative ceilings on the various types of exposure; or (3) pricing the risk, i.e., revaluating the assets, which enables the risk to be controlled by investment decisions. When the Bank assesses that the risk is too high, it avoids it via one of the methods listed above, including total prohibition of the exposure. At relatively low levels, risks are managed by means of restrictions, and in some instances, particularly of exposure to an international institution or a country, also by pricing the risk.

The Bank's most fully developed tool for restricting credit risk is its System of Limits and Quotas, in which quantitative ceilings are imposed on the exposure to investment banks, commercial banks, international institutions and countries. The system determines a minimum threshold for the credit quality of the individual institution, and also ensures proper dispersion between institutions and countries in accordance with their size and quality. The system's primary influence is on the Bank's activities in the interbank deposit market, and it also plays an important role in decisions on foreign exchange transactions (due to the risks inherent in their settlement) and in activity in government securities. Other tools for restricting credit risk include a ceiling on the total exposure of the reserves to the worldwide banking system, quantitative restrictions on investment in spread assets, and limitations on the period of certain types of exposure.

Pricing is another tool that aids control of credit risk of investment in certain securities. As the securities are traded in liquid markets which are continually

active, any change in the level of risk of a particular country, as estimated by participants in the market, is immediately reflected by a change in the price and yield to maturity of the securities. For example, changes in the yield spread between Eurobonds and risk-free debt instruments in the same currency provide a good indicator of the assessments of the issuer's risk. The widening of the yield spread thus gives a warning in real time of a change in the situation of the issuing country. Moreover, as the reserves portfolio is revalued daily, price changes are continuously translated into profit or loss. This encourages portfolio managers to reduce the exposure to entities whose credit risk is on the rise.

The international banking community is taking steps to reduce credit risk. Marked progress has been made with regard to the exposure arising from the time lag in settlement: in the last few years 'delivery versus payment' (DVP) systems for settling securities transactions have become more widespread. In the DVP process, securities and the payments for them are transferred simultaneously, so that the credit risk in settlement disappears. A similar system is to be introduced in 2002 for trading in the main foreign currencies, when the Continuous Link Settlement (CLS) Bank is established: the CLS Bank will serve as an international clearing house in which the two financial flows which make up the currency transaction are settled simultaneously.

Another system, involving charging daily margins (i.e., daily valuation differentials) applies to futures transactions on the commodity exchanges; this system greatly reduces the risk during the life of the future transaction. The 'margin' method and the 'netting' method (offsetting receipts against payments) is accepted also in other types of futures transactions such as currency forwards and swaps and in repo and reverse repo transactions. The Bank of Israel intends to complete the implementation of these systems in the context of its reserves management, thereby in effect reducing their exposure to credit risk.

The reduction of credit risk is also achieved by anchoring bilateral liabilities in standard written contracts. The demand for this has grown constantly in the last few years, on the part of the Bank of Israel and other participants in international markets, due to growing awareness of credit risk as the number and size of transactions in the markets have increased, and in the light of the developments in legislation and court rulings in the countries where the leading financial markets operate. The standard contract for every financial market is determined by each market's coordinating body, and it serves as an accepted basis for activity between all parties active in that market.

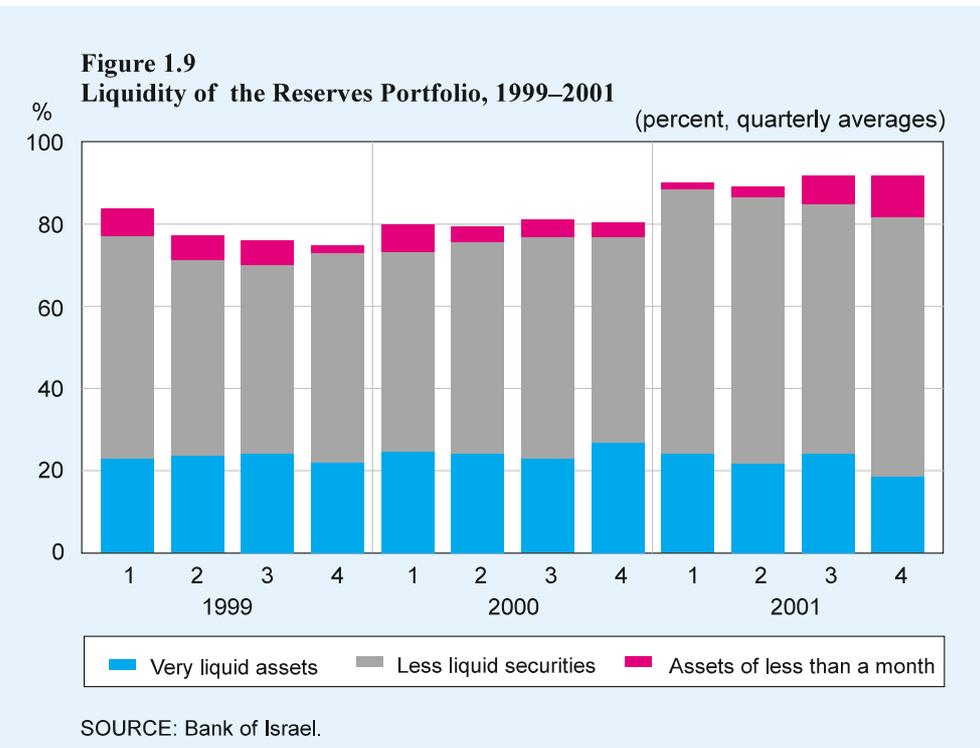
4. THE LIQUIDITY OF THE RESERVES

To allow assessment of the level of liquidity of the reserves, the Bank of Israel classifies assets according to the possibility of selling them without the sale itself causing a loss (see Box 1.8 for a definition of liquidity).

The reserves portfolio is characterized by high levels of liquidity and tradability. In 2001 its liquidity rose, due to a change in its composition and due to the increased liquidity of many euro-denominated securities.

The criterion employed in classifying securities into different levels of liquidity is the bid-offer spread. Nontradable assets are classified by time to maturity. As can be seen from Figure 1.9, more than 20 percent of the total reserves is invested in the most liquid assets, i.e., assets which are traded in very deep and liquid markets, and which can be sold very quickly without the sale itself leading to a loss. A further 60 percent of the portfolio is invested in highly liquid assets, but less liquid than the first group, and about 5 percent is invested in assets maturing in less than a month.

Some 10 percent, on average, of the reserves portfolio in 2001 was invested in assets with relatively low liquidity, although they are tradable and can be realized. The share of this group—which in 2001 included Eurobonds and GNMA—s—in the total declined during the year. (The mirror image of this decline is the rise of the share of the liquid part of the portfolio, shown in Figure 1.9.) There were two reasons for this: the first was the change in the composition of the portfolio, especially the decline in investments in synthetic trades as their relative advantage over other investments all but vanished during the year. The second reason was the change in markets’ liquidity, in particular the rise in the liquidity of TIPS, which had been previously been considered part of the relatively less liquid share of the portfolio, and a rise in the liquidity of many euro-denominated securities. The improved liquidity of these securities was largely due to the move to single-currency trading in the European capital markets. Single-currency trading renders currency conversions by investors from different countries unnecessary, and thus lowers the transaction costs of trading in such securities. It also helps to increase the transparency of security prices, making the securities more liquid.



In the light of the high level of the reserves and the ability to sell a large part of them in a short time without thereby incurring a loss it appears that their liquidity level is satisfactory.

Box 1.8: The Liquidity of the Reserves Portfolio

The liquidity characteristic of a financial market relates to the ability to operate in that market—to buy and sell—at the desired volume and time, without affecting the prevailing market price. As a result, in assessing the extent to which the reserves portfolio is liquid, the question to be asked is, what part of the portfolio can be realized immediately and without loss, i.e., at a price as close as possible to the prevailing market price of the realized assets.

There are several aspects to the liquidity of the market. The first is a narrow bid-offer spread; the existence of narrow spreads implies low transaction costs relative to the midpoint price, reducing the cost of ongoing activity in these assets. The second is the ability to operate at large volumes without affecting the market price. In an illiquid market, an attempt to realize an asset will be expressed by the widening of the spread, so that a sale can go through only at a lower price than that prevailing in the market before the sale. The change in the market price deriving from the actual sale reduces the holding-period rate of return below what it would have been had there not been a sale, so that the portfolio incurs a loss as a result of the sale. On the other hand, changes in market prices due to other factors affect the holding-period return on the assets whether they are sold or not.

According to this approach, the assets included in the reserves portfolio were divided into several groups, by liquidity:

1. Very liquid securities, i.e., those with a spread of 0–2 basis points, or 0–2 cents, and various demand deposits.
2. Less liquid securities, i.e., those with a spread of 3–5 basis points, or 4–6 cents.
3. Securities and deposits whose maturity is within a month and repo and reverse repo transactions of less than a month.
4. All other assets.

5. YIELD AND RISK IN THE MANAGEMENT OF THE RESERVES

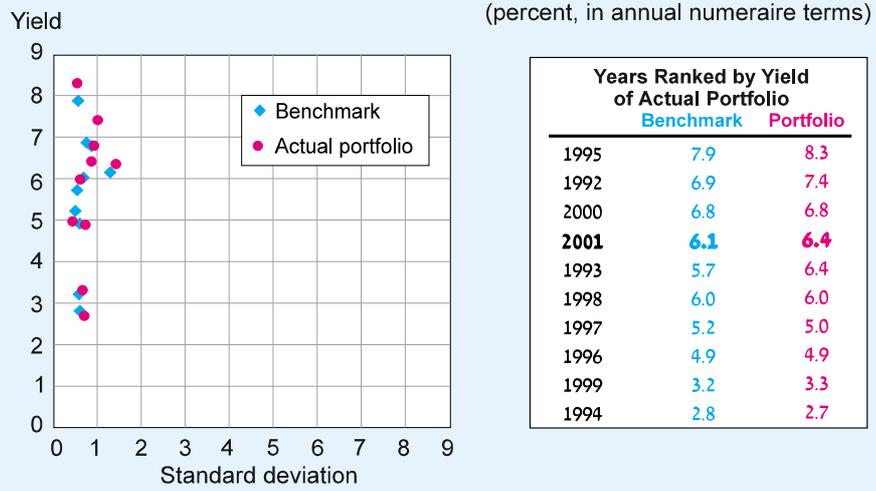
a. The yields on the portfolio and the benchmark and their volatilities

The yields on the reserves portfolio and on the benchmark portfolio and their volatilities since 1992 are shown in Figure 1.10 and Table 1.2. The table shows that the yield on the portfolio and its volatility were very close to those of the benchmark in every one of those years.

The figure highlights the fluctuations in the annual holding-period rate of return on both the portfolio and the benchmark, which are affected by market developments from year to year. In contrast to these fluctuations, the stability of the intra-year volatility of the holding-period rate of return is notable.

The yield on the portfolio and its volatility were very close to those of the benchmark in every year since 1992.

Figure 1.10
Yields of Actual and Benchmark Portfolios, 1992–2001



SOURCE: Bank of Israel.

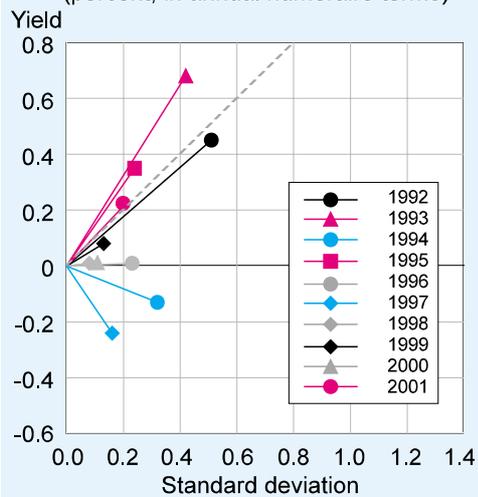
b. The incremental yield and its volatility

In the day-to-day management of the portfolio, the benchmark portfolio serves as a neutral or risk-free portfolio. A deviation from the benchmark composition means opening a position, which implies a difference between the yield of the portfolio and that of the benchmark and also between their respective volatilities. These differences can give an indication of management skill: skilled management is the ability to outperform the benchmark consistently over time. As the performance of each manager can be volatile, the ideal situation is obtaining a positive increment which is high relative to its volatility.

Figure 1.11 and Table 1.2 give the average differences between yields on the portfolio and those of the neutral benchmark in the years from 1992 to 2000, and the volatility of the differences. The ratio of the incremental yield to volatility (known as the 'information ratio') is reflected in the figure by the slope of the line for each year. The objective is to achieve a ratio greater than one, because in that situation the incremental yield more than compensates for the additional risk incurred. The figure shows that the ratio exceeded one in 1993, 1995, and 2001 (the slope of the lines in those

The ratio of incremental yield to volatility (the 'information ratio') was positive in most years in the last decade.

Figure 1.11
Yield Differences vis-à-vis Neutral Benchmark Portfolio, 1992–2001
 (percent, in annual numeraire terms)



SOURCE: Bank of Israel.

years was greater than the slope of the rising dotted line, which represents a ratio of 1), it was close to one in 1992 and 1999, and it was negative in only two years in the last decade.

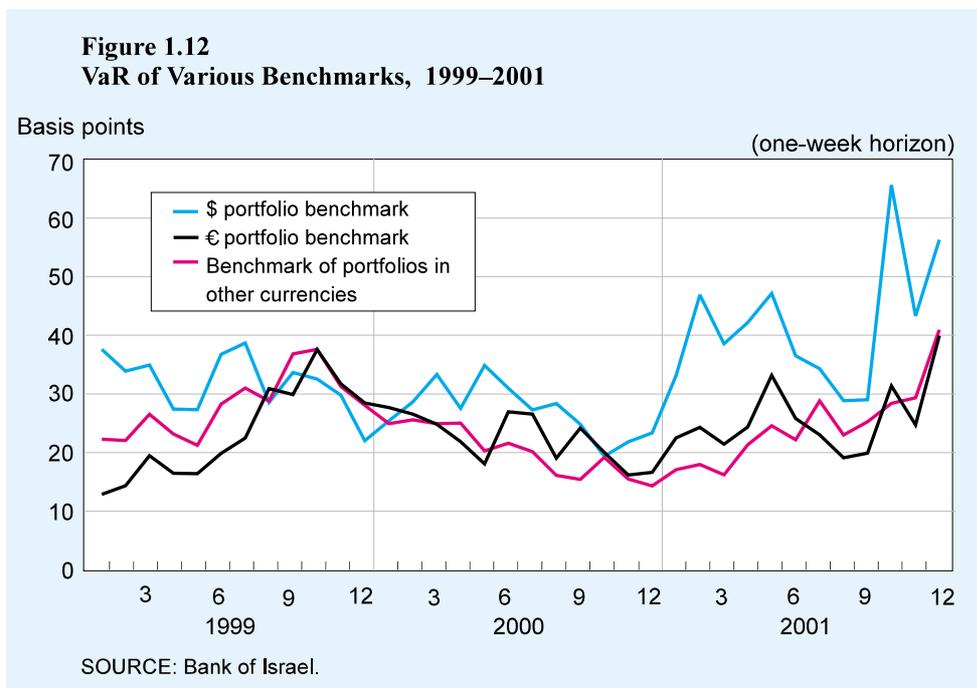
c. Value at risk

Value at risk (VaR) is another indicator of the risk of a portfolio; it is the estimate of the largest loss that the portfolio can incur in a given period of time with a given probability (see Box 1.9).¹⁰ The maximum loss estimated by the VaR is capital loss (as is the profit or loss estimated by duration), and does not include the element of income related to the level of yield to maturity (the ‘carry’).

VaR is not yet used as a tool of day-to-day risk-management of the Bank of Israel portfolio. However, VaR of various assets and portfolios is watched closely, primarily to assess the market risk in the main markets in which the reserves are invested. The VaR over time of portfolios with similar compositions to those of the benchmark currency portfolios is shown in Figure 1.12. The figure shows that the VaR of the benchmark portfolios rose in 2001, with the sharp rise in the VaR of the dollar benchmark the most marked. This rise, which signifies a considerable increase in risk in the US Treasury market, was caused by the steep increase in the volatility of that market. The risk in the US market rose because of the increased uncertainty regarding the level of economic activity, and because of the sharp loss of confidence following the terrorist attacks in September, as well as the bankruptcy of the Enron energy trading company at the end of the year.

The Department uses VaR to estimate the risks in various markets. In 2001 the risk in the US Treasury market rose considerably.

The risk of positions related to investments in the capital and money markets rose during 2001. The risks of currency positions, however, did not rise.



¹⁰ There are various approaches to VaR. The VaR shown in this report is generally estimated using the ‘parametric’ approach, assuming that profits and losses have a normal distribution.

Figure 1.13
VaR of Positions in Various Markets,
1999–2001

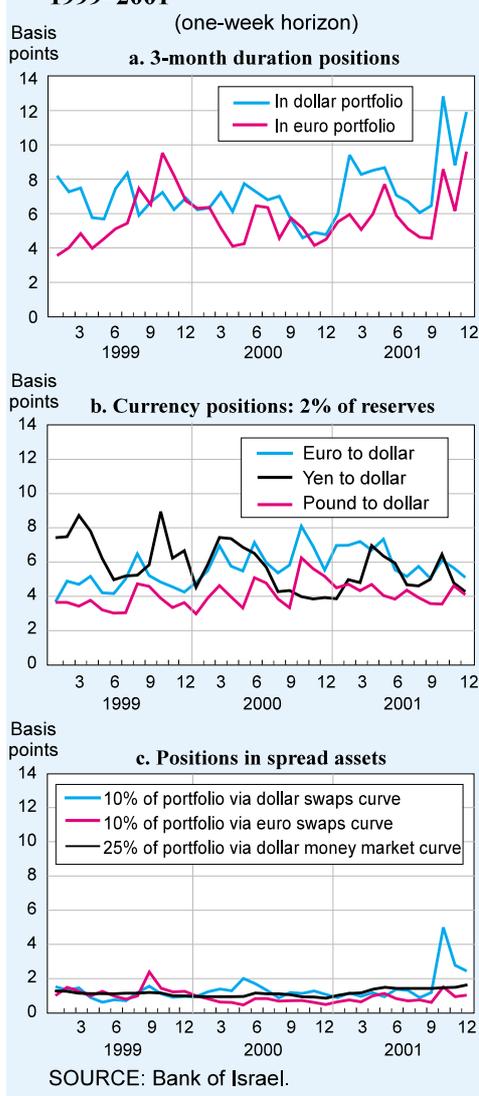


Figure 1.13 shows an estimate of the level of risk inherent in various positions. The risk is shown in terms of VaR incurred in the following positions: a three-month difference in duration between the currency benchmark and the currency portfolio (Figure 1.13a);¹¹ various currency positions equal to 2 percent of the reserves portfolio (Figure 1.13b); and the VaR of an investment in spread assets (which are not included in the benchmark) of 10 percent of the reserves portfolio (Figure 1.13c).¹² The figure shows:

- The risk of the duration positions is quite similar to that of the currency positions, and in 2001 was estimated at 3–9 basis points. The risk of investment in spread assets and market risk incurred by exposure to the banking industry, on the other hand, was lower throughout the year, and was estimated at 1–2 basis points.
- The risk of positions related to investments in the capital and money markets rose during 2001. The risks of currency positions, however, did not rise.
- The risk of duration positions and of investment in spread assets rose sharply following the terrorist attacks in the US in September, and then fell back again. This was also reflected in the changes in spreads described above (see also Box 1.3).

¹¹ VaR is shown in basis points relative to the size of the currency portfolio. Clearly, when portfolios differ in size, so do the potential financial losses, so that the effect on the total reserves portfolio differs.

¹² The size of the duration position is the maximum allowed lengthening of the portfolio vis-à-vis the benchmark, and that of the currency position is the maximum allowed deviation in every currency from the composition of the numeraire set for the Foreign Currency Department. The size of the exposure to the money market is the ceiling on the exposure of the reserves to the banking industry, and the size of the position in spread assets is the maximum exposure set by the Department for this type of investment. Actual currency and duration positions tend to be far smaller than those permitted.

Box 1.9: Value at Risk as an Index of the Risk of an Investment Portfolio

Risk is essentially a statistical concept, and in the context of managing investment portfolios it refers to the degree of uncertainty in the distribution of the portfolio's losses and profits. The two most widely accepted indices of risk are volatility and Value at Risk (VaR).

Volatility is one standard deviation of the distribution of holding-period rates of return. Under certain assumptions the combination of expected yield and volatility can provide an estimate of the typical range of the yields over a unit of time (usually a year). On the other hand, VaR focuses on a point on the distribution curve of profits and losses, and expresses the extent of the loss that the portfolio could incur at a given level of probability over a specific period of time (e.g., if it is given that in a certain portfolio the VaR over one day at a 97.5 percent confidence level is \$ 1 million, this means that there is a 2.5 percent chance that the existing portfolio will lose more than that amount within 24 hours).

Volatility and VaR will be identical if all the following conditions apply: both of them refer to an identical period of time, the distribution is normal, and the specific probability is 1/6. VaR is generally used in instances of shorter periods (e.g., a day or a month), with a lower probability (e.g., 1/100, 1/20), and where the distribution is not normal. In such cases VaR is larger than volatility, and instead of representing a typical range of yields it represents a statistical estimate of the total possible loss.

The fact that VaR takes the distribution of profits and losses into account distinguishes it from *duration*. The duration measure expresses the profit or loss given a specific change in the market, but does not take into account the chance that such a change will occur. Thus, duration is a mathematical characteristic of the asset or the portfolio itself, while *VaR*, which is a statistical concept, takes into account also the exogenous factors affecting the portfolio.

Calculating VaR

There are several methods of calculating VaR:

- ◆ The parametric method. In this method parameters of the distribution are estimated from historical data of the holding-period rates of return on different assets. Assuming that the yield distribution is normal, a link can be established between the estimated standard deviations and probability.
- ◆ The second method is also based on historical data of holding-period rates of return, but makes no assumption about the distribution. Actual profit-and-loss is graded, and the VaR is determined according to its position in the grading. (For example, if there are 260 observations, then for a 95% confidence level the loss graded thirteenth of the worst is the VaR.)
- ◆ The 'Monte Carlo simulation' estimates the parameters of the distribution of the rate of return under a given assumption, based on very many (about 10,000) random scenarios of the holding-period rate of return. The VaR is calculated from the estimated parameters.

In this publication the VaR is generally calculated by the parametric method and is based on the assumption that the yield distribution is normal. When this assumption seemed too restrictive, such as in calculating the VaR of assets priced according to market interest rates, the historical method was used instead. In all cases the calculation is based on weighted observations, and the later the observation, the higher the weighting (the weighting coefficient—the decay—used was 0.94). The program used for the calculations was RiskManager.

APPENDIX 1.1: MAIN MARKET DEVELOPMENTS IN 2001

General developments

Growth rates in all the major economies were lower in 2001 than in 2000. The most notable instances of decline were in the US, where GDP rose by only 1 percent in 2001, down from 4.1 percent in 2000, and in Canada, with a rise of 1.4 percent compared with 4.4 percent in 2000. In the euro zone and the UK the slowdown was more moderate, with GDP rising by 1.5 percent and 2.5 percent respectively, down from 3.4 percent and 3.0 percent in 2000. In Japan a weak 1.5 percent increase in 2000 turned into an actual drop in GDP of 0.4 percent in 2001. The slowdown in 2001 was also evident in the emerging markets, especially in the more recently industrialized Asian countries—Hong Kong, Korea, Singapore and Taiwan—which were affected by the slowdown in the high-tech industries, in Mexico, which is particularly affected by developments in the US economy, and in Argentina and Turkey, which suffered from persistent financial crises.

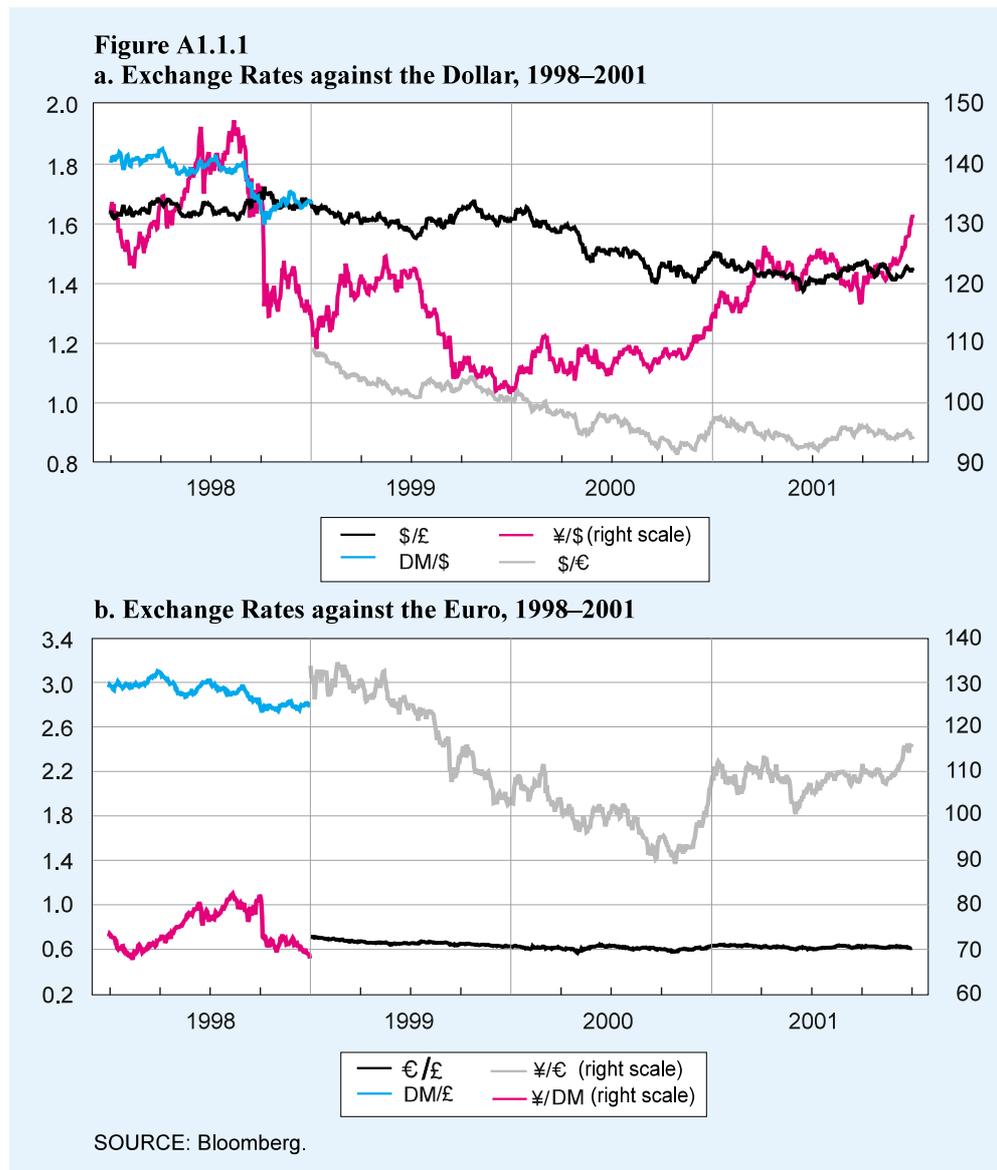
The background to the global slowdown in growth was provided by interactive developments in different fields, including the tight monetary policy adopted in the US and the euro zone in 2000; the change in long-term company profit expectations in the capital markets; high energy prices (although these did decline towards the end of the year); and the marked decline in individuals' and companies' economic confidence. One key factor in this regard was the slump in the price of shares of most high-tech companies, which was accompanied by a sharp fall in new investment and demand in this area. The international links which characterize production processes in high-tech industries played a not insignificant role in spreading the slowdown worldwide. The implications of the terrorist attacks in the US on 11 September were another important contributory factor. An analysis by the IMF¹ identified four main channels via which the attacks affected the global economy: direct destruction of life and property; the undermining of consumer and business confidence; the reaction of the financial markets; and the drop in prices of commodities, especially fuel. The direct short-term cost was estimated at about \$ 21 billion, but the long-term effects depend on numerous factors, and are therefore difficult to estimate.

Inflation rates in the main advanced economies excluding Japan remained close to their levels in 2000, i.e., in the 2-3 percent range. In Japan prices fell for the third year in succession. Unemployment in the US rose considerably, from 4 percent at the beginning of the year to 5.8 percent at the end, but in the other major economies unemployment either remained stable or increased more slowly.

Exchange-rate developments

In the first half of 2001 the dollar continued to strengthen against the other principal currencies, continuing the trend evident in 2000. From the end of December 2000 until it peaked in about June 2001, the dollar rose by 13 percent against the euro and 9 percent against the pound sterling (the turnaround occurred on different days for

¹ "How has September 11 Influenced the Global Economy?" in *World Economic Outlook*, December 2001.

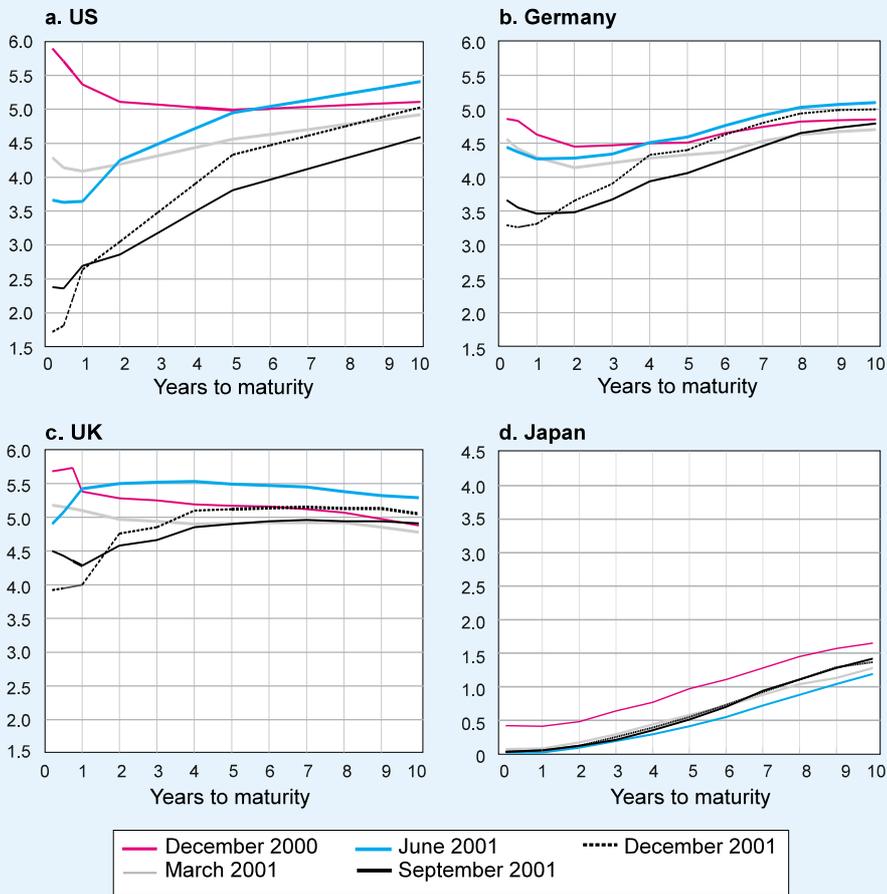


different currencies). From its peak until the end of the year the dollar weakened by 6 percent against the euro and the pound. The dollar strengthened against the yen by 15 percent over the whole year (Figure A1.1.1).

Interest rates and yields

The central banks of the major economies reacted to the events described above by taking expansionary monetary measures, expressed by reducing short-term interest rates. In the US the Open Market Committee of the Federal Reserve started a series of interest-rate cuts in January which reduced the rate from 6.5 percent at the beginning of 2001 to 1.75 percent at the end of the year, with a 3 percentage point reduction up to September, a 1 percentage point reduction, in two stages, in the month after 11

Figure A1.1.2
Yield Curves of Government Bonds, 2001

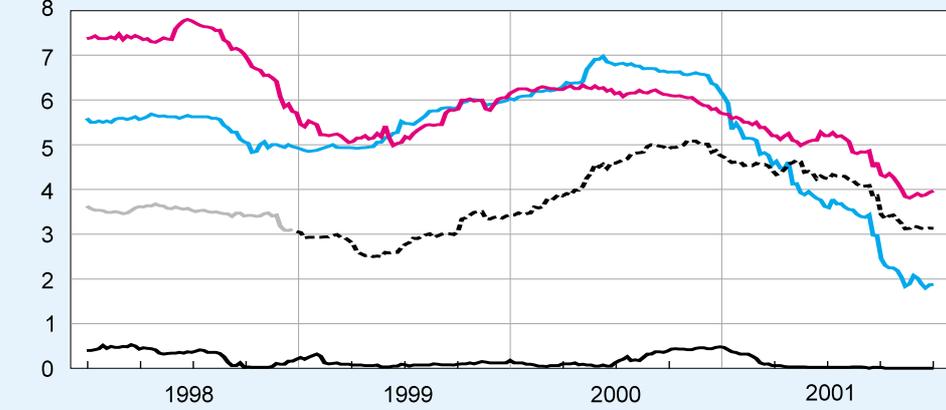


SOURCE: Bloomberg.

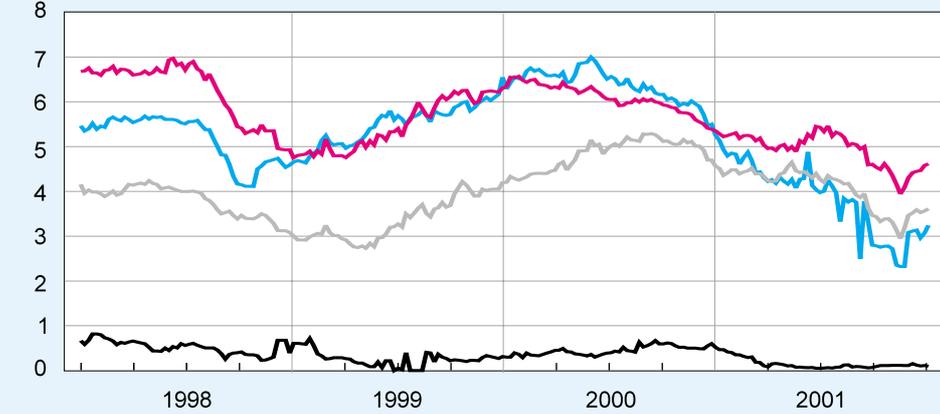
September, and 0.75 of a percentage point in the last two months of the year. In the UK and the euro zone, where the slowdown was less pronounced, the monetary authorities reduced interest rates more slowly, from 6 percent to 4 percent in the UK, and from 4.75 percent to 3.25 percent in the euro zone. The interest rate in Japan remained close to zero.

As short-term interest fell, so did the yield to maturity on government bonds. Nevertheless, the longer the term to maturity, the more moderate was the decline in yield. In the US the yield to maturity on government bonds maturing in two years fell from 5.10 percent at the end of 2000 to 2.31 percent at the beginning of November 2001; it rose again in November and December, and reached 3.05 at the end of the year. Yields on government bonds maturing in two years in the euro zone and the UK declined more slowly, from 4.5 percent to 3.6 percent in the former, and from 5.3 percent to 4.3 percent in the latter. In contrast, the yield on bonds maturing in ten years remained relatively stable throughout the year in those markets—at about 5 percent in

Figure A1.1.3
a. 6-month Euro Interest Rates, 1998–2001



b. 2-Year Government Bond Yields, 1998–2001



c. 10-Year Government Bond Yields, 1998–2001

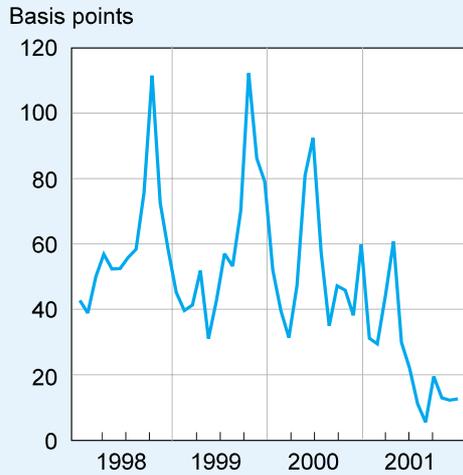


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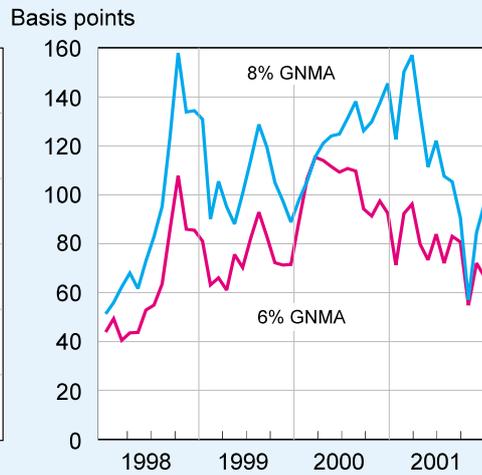
SOURCE: Bloomberg.

Figure A1.1.4

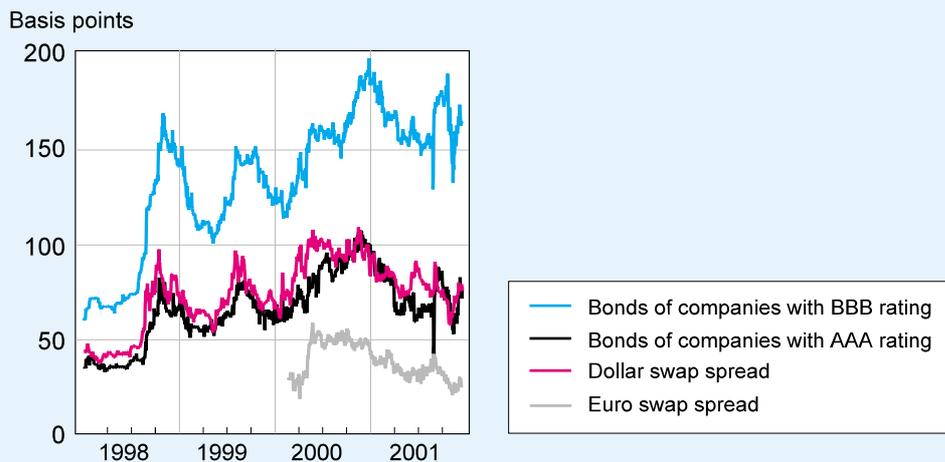
a. US Dollar TED Spread, 1998–2001



b. GNMA OAS Spread, 1998–2001



c. 5-year Spreads, 1998–2001



SOURCE: Bloomberg and Salomon Analytics.

the US and between 4.5 percent and 5 percent in the UK and Europe. As a result the shapes of the yield curves altered, from a negative slope in the US and the UK and flat in the euro zone, to a positive slope. In Japan the yields on government bonds remained at a low level throughout the year (Figures A1.1.2 and A1.1.3).

The swap spread, which had started to contract in the second half of 2000, continued to shrink in 2001 (see Appendix 1.2), and this was evident along the whole of the yield curve for the dollar as well as the euro. The TED spread also narrowed throughout the year.

These developments were caused by several elements, including a change in investors' expectations regarding fiscal policy in the US and Europe in the next few years and the implications of that policy for the extent of future issues of government bonds; a change in the issuance policy of the US Treasury Department in favor of (short-term) bills; the willingness of those investing medium term to be exposed to higher risks to obtain higher yields, as the yield on government bonds had fallen below the minimum threshold they required; and hedging activity by portfolio managers in the mortgage-backed securities market (Figure A1.1.4).

APPENDIX 1.2: GLOSSARY

Annual terms	The yield that would have been obtained if the rate of change in the period reviewed would have prevailed for a year.
Basis point	A 0.01 percent change or one ten thousandth part.
Benchmark portfolio	A hypothetical portfolio built according to pre-set rules that serves as a criterion for assessing the performance of an investment manager and as an anchor for managing the risks to which the portfolio he manages is exposed (see Box 1.2).
Credit risk	Exposure to the possibility of loss as a result of the failure to repay debts on time by an issuer, financial institution, or country, or as a result of changes in the assessment of the probability of such an event by market participants.
Currency risk	Exposure to the possibility of loss as a result of changes in exchange rates.
Currency terms (e.g., US dollar terms)	The yield obtained when the running values of all assets are multiplied by the running exchange rates into a specific currency or basket of currencies.
Duration	Refers to modified duration, unless noted otherwise. The ratio of a small change in the value of a debt instrument, as a percentage of its previous value, to the accompanying change in its yield to maturity (with a reverse sign). It is measured in units of time. See <i>portfolio duration</i> , <i>partial duration</i> , below.
Eurobonds	Bonds sold in financial markets outside the country in whose currency they are denominated.

Foreign exchange reserves	Financial assets issued abroad and denominated in foreign currency (including gold) which are owned and controlled solely by the central bank and are not encumbered in any way.
GNMA	Mortgage-backed securities issued by the Government National Mortgage Association and fully guaranteed by the US government.
Holding-period rate of return	Rate of change in the value of an asset or portfolio over a defined period.
Interest-rate risk	Exposure to the possibility of loss as a result of changes in interest rates or yields to maturity.
Investment policy	The standards and procedures set by an investor regarding his investments, in accordance with his long-term preferences, objectives, and strategies.
Legal risk	Exposure to the possibility of a loss as a result of the wording of a contract, in error, to the investor's disadvantage.
Liquidity	The ability to realize assets without delay and without diminishing their value.
Numeraire	The currency composition set as the benchmark for the reserves portfolio (see Boxes 1.1, 1.2)
Neutral	The value of a specific characteristic of a portfolio when it is <i>risk-free</i> (see below).
Operational risk	Exposure to the possibility of a loss as a result of system failure, human error, and the like.
Portfolio duration, partial duration	The average <i>duration</i> of a portfolio of debt instruments (duration of each asset being weighted by its share in the portfolio) is the accepted index for estimating the interest-rate risk of the portfolio. However, as it is defined, duration measures sensitivity to <i>parallel and small</i> changes in the yield curve. In practice, shifts in the curve are often accompanied by changes in its slope.

The *partial duration* in a specific area of the curve is obtained by multiplying the duration of the assets invested in that area by their weight in the portfolio, and measures the portfolio's exposure to a parallel shift in that area only. The sum of the partial durations over the curve is equal to the duration of the entire portfolio.

Repo, Reverse repo	Abbreviation for Repurchase agreement, i.e., the purchase of a security alongside the undertaking to sell it back at a future date and a known price. In economic terms, the transaction is identical to a collateralized loan. When the Bank of Israel buys a security for future sale the transaction is known as a Reverse repo, and in the opposite case as a Repo.
Risk-free	A situation in which the investor can incur neither losses nor profits.
Spread asset	An asset whose yield to maturity comprises the yield on another asset (e.g., a government bond) <i>plus</i> a yield spread that changes, usually continuously and moderately, in accordance with changes in the supply of and demand for assets of that type.
Standard deviation	A statistical measure of the spread of a distribution around its mean; often used as a measure of the extent of exposure to uncertainty (see <i>volatility</i> below).
Swap	A long-term agreement, under whose terms one party pays the other the interest on a specified sum of money (the notional principal) according to a known variable interest rate (e.g., LIBOR), while the other party pays the first the interest on the notional principal at a fixed rate as determined in the agreement. The series of fixed interest rates prevailing in the market is known as the <i>swap curve</i> and the difference between it and the government-bond yield curve at a specific maturity is called the <i>swap spread</i> (see below) for that maturity.

Swap spread	The difference between the yield to maturity on government bonds and the fixed interest that one party pays the other in a <i>swap agreement</i> (see above) for a similar period.
Synthetic trade	A pair of transactions, in one of which a security denominated in a currency other than that of the portfolio in which it is held is bought, while the other involves a forward foreign exchange trade from the currency of the security into that of the portfolio. The forward foreign exchange trade settles on the date on which the security matures and is for an amount equal to its value at maturity.
TED spread	Treasury-Euro-Deposit spread, i.e., the difference between the yield to maturity on short-maturity government debt and the interest rate on a deposit with the same maturity.
TIPS	Acronym for Treasury Inflation-Protected Security—a CPI-indexed US government bond.
Trade	An agreement to transfer or encumber ownership of financial assets, e.g., foreign currency or securities.
VaR	Acronym for Value at Risk, the greatest loss, with a given probability, that is expected to occur within a defined period of time (see Box 1.9).
Volatility	The size of the <i>standard deviation</i> (see above) of the distribution of the holding-period rates of return on a financial asset, such as a security or portfolio, over a specific period of time (day, week, etc.). It is usually calculated on the basis of the logarithm of the holding-period rate of return, $\log(1 + y)$, where y is the simple rate of return.
Yield curve	A series of yields to maturity of bonds with different dates to redemption and with characteristics in common (e.g., government bonds of a specific country in its local currency).

Yield spread	The difference between the yields to maturity of two debt instruments.
Yield to maturity	The holding-period rate of return, in annual terms, that would be obtained by keeping a debt instrument until its final redemption date, if it were possible to invest all its cash flows at the same yield until the final redemption date (also called internal rate of return).