Bank of Israel

Market Operations Department

Investment of the

Foreign Exchange

Reserves

Annual Report 2017

Contents

Main developments

- Israel's foreign exchange reserves totaled $113 billion at the end of 2017[1], an increase of $14.6 billion over the course of the year. The main factors in the increase were gains, income, price and exchange rate differentials (mark to market), which totaled a combined $7.5 billion, and Bank of Israel purchases of $6.6 billion within the framework of monetary policy.

- At the end of 2017, the level of reserves was slightly above the upper bound of the range of the appropriate level of reserves, of $70–110 billion, and was equivalent to 33 percent of GDP.

- In 2017, the holding rate of return on the reserves portfolio was 3 percent in numeraire terms, which is a basket of currencies—primarily comprised of the dollar and euro. This rate of return is the highest since 2009 and greater than the average return over the past three years of 1.7 percent.

- The rate of return was achieved in a financial environment of low yields to maturity, and even negative yields, on a considerable portion of bonds issued by major European countries, in which about one-third of the reserves are invested.

- The rate of return was achieved mainly as a result of a long term process, in which the share of reserves invested in risk assets—equities and corporate bonds—was gradually increased. This is within the framework of the risk level approved by the Monetary Committee.

- The contribution of active management—the investment's actual deviation from the basic benchmark—was 273 basis points this year. Most of the contribution, 219 basis points, came from the investment in equities that benefited from the continued strong performance of equity markets in the investment countries. The rest of the contribution, 54 basis points, derived mainly from specific selection of duration and investment in spread assets, particularly in short term assets.

- The Monetary Committee decided to slightly increase the portfolio's risk level, and the percentage of risk assets in the reserves portfolio continued to grow: the share of investment in equities increased to 13.3 percent at the end of the year, from 10.0 percent, and the share of investment in corporate bonds increased to 6.0 percent, from 4.8 percent. For most of the year, the share of investment in corporate bonds was 7.5 percent, and it was reduced toward the very end of the year.

- Market volatility was exceptionally low this year, against the background of excess liquidity resulting from central banks' actions and the increasing global growth alongside low inflation. Therefore, the reserves portfolio's level of volatility was lower than in the previous year, despite the increased share of risk assets, and was more worthwhile than in the past in terms of risk-adjusted yield.

[1] The level of the reserves throughout the Report includes the International Monetary Fund's allocations of SDRs and the balance of Israel's reserve tranche in the IMF. At the end of 2017, their combined level was approximately $1.5 billion. For more on this issue, see "Bank of Israel Financial Statements for 2017" (forthcoming).

- The Bank of Israel's decision to invest part of the foreign exchange reserves in equities was taken with a long term view. The investment in equities more than doubled the cumulative return of the reserves portfolio in the past 6 years, but as equity markets are cyclical and volatile, it is reasonable to expect price declines in the future as well. (See the box on investment in equities in Chapter 4).

Introduction

This report presents the results of the investment of Israel's foreign exchange reserves in 2017 and from a multiyear perspective, as well as the framework of how they were managed. Israel's foreign exchange reserves were $113 billion at the end of 2016 (Table 1). The annual return on the holdings was 3.03 percent in terms of a basket of currencies—the numeraire[2]—and the active management contribution[3] was 273 basis points. The average return over the past three years was 1.74 percent, and the contribution of active management was 154 basis points. The cumulative contribution of active management was 468 basis points over the past three years and 663 basis points over the past five years.

TABLE 1 - Foreign Exchange Reserves' Level, 2015–17, and Annual and Multiyear Holding Rates of Return

	FX Reserves Level (millions $)	
	End of year	Average
2015	90,575	87,389
2016	98,447	95,777
2017	113,011	107,567
	Return's Yearly Averages (%, in numeraire terms)	
	1 Year	3 Year	5 Year
	2017	2015 - 2017	2013 - 2017
Portfolio return	3.03	1.74	1.47
Basic benchmark return	0.30	0.20	0.18
Active management contribution (b.p)	273	153	129
	Cumulative Return (%, in numeraire terms)		
Portfolio return	3.03	5.31	7.58
Basic benchmark return	0.30	0.61	0.90
Active management contribution (b.p)	273	468	663

Source: Bank of Israel

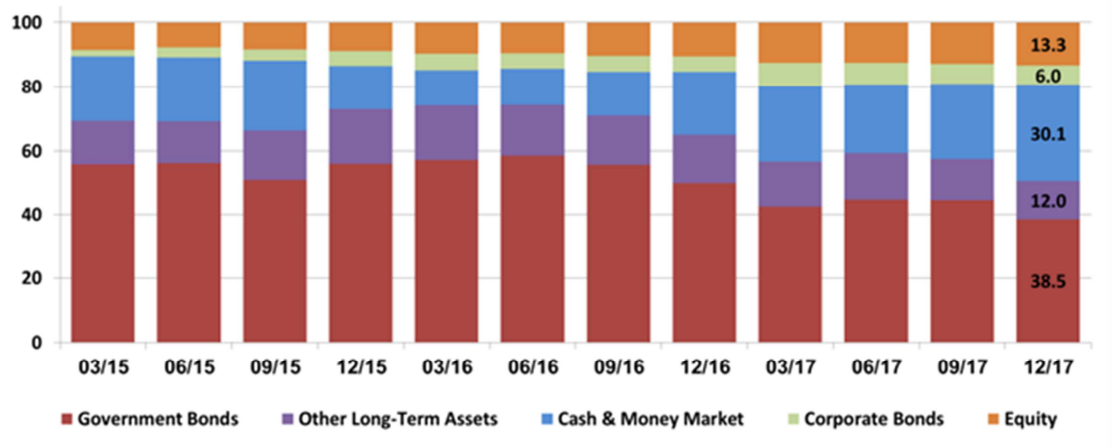
At the end of 2017, 61.6 percent of the reserves were invested in government bonds[4], and 13.3 percent were invested in equities (Figure 1). The proportion invested in equities increased this year, as in recent years, rising by 3.3 percentage points in 2017, and the proportion of investment in corporate bonds increased by 1.2 percentage points.

[2] The numeraire is a currency basket in which the foreign exchange reserves are measured. See Chapter B, Section 3 in this report.

[3] The contribution of active management is the difference between the return on the reserves portfolio and the return on the basic benchmark (the benchmark whose currency composition is identical to the composition of the numeraire). It measures the decisions to invest in additional assets and in additional countries not included in the basic benchmark. For further discussion see Chapter B, Section 3.

[4] Including deposits and cash at central banks, whose inherent risk level is equal to the country risk inherent in government bonds.

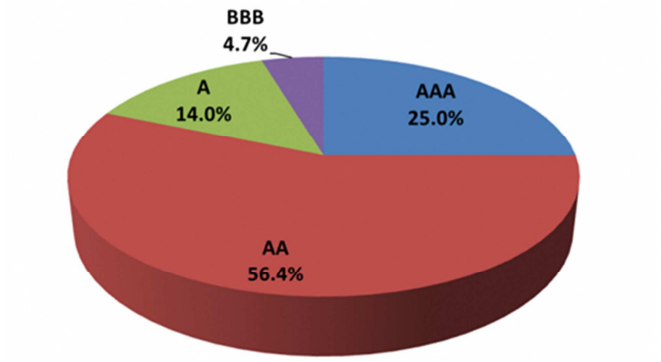
FIGURE 1: Asset Distribution of the Reserves Portfolio, 2015–17
(percent, end of quarter)



Source: Bank of Israel

The credit quality of the reserves, which reflects the risk of insolvency by the party issuing the debt, as measured by the credit ratings, is high: 63.3 percent of the bonds in the reserves portfolio are rated in the two highest categories (AAA, AA+) (Fig. 2). The proportion of holdings in the lowest rated group, BBB, is only 4.7 percent, invested in corporate bonds. Holdings in bonds that are not investment grade are prohibited by the investment guidelines.

FIGURE 2: Distribution of Bonds in the Foreign Exchange Reserves, by Credit Rating December 31, 2017



Source: Bank of Israel, S&P

The holding and management of foreign exchange reserves, both in Israel and abroad, are designed to provide liquidity during emergencies and at times of financial crises. In recent years, the management of Israel's reserves, as in many countries, has been undergoing changes and adjustments resulting from the size of the reserves and the diversification of the investment by adding risk assets. The motives underlying the increase in reserves worldwide and the changes in their composition are the challenging economic and financial background conditions that have prevailed worldwide since the 2008 global crisis—primarily the absence of substantial economic growth as well as monetary accommodation for the purpose of encouraging growth—together with the range of tools used for this purpose. The global crisis highlighted the need for

a higher level of reserves than previously assessed in order to cope with the ramifications of crises of this type. The level of reserves was also raised in many countries in order to protect the domestic currency against appreciation and its consequences. These monetary expansions are reflected in the market in excess liquidity and low or even negative interest rates and yields to maturity, which threatened to result in low rates of return in the reserves portfolios.

In Israel, two conditions made it possible to add risk assets to the portfolio: the change in the Bank of Israel Law (the original law only allowed investment in a narrow range of assets), and the growth of the reserves, which created a cushion for absorbing potential losses. Under the influence of these changes, management of Israel's reserves features, more than in the past, the choosing of investments with a relatively high expected return alongside higher, though calculated and limited, risk. The investments are allocated in a complex process, along with an enhanced effort to find and take advantage of investment opportunities.

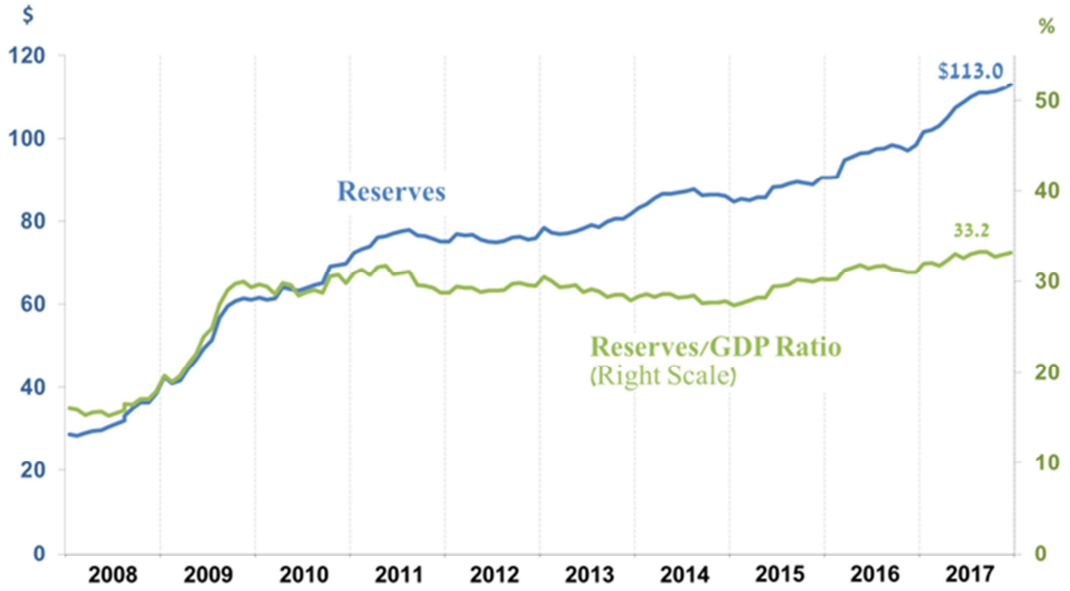
Chapter A presents the reserves' level, its change during the year, and the adequate level for the reserves. Chapter B presents the framework for managing the reserves from the perspective of the investment objectives, the maximum risk level, the basic benchmark, and the strategic allocation. Chapter C presents the investment performance in 2017 and over multiyear periods; and Chapter D presents the total contribution of active management broken down by various risk components: equities, duration and diversification, spread assets, including corporate bonds; and Chapter E presents various measures for risk and risk-adjusted return. The appendices present the global economic and financial environment, the principles for determining the adequate level of the reserves, the policy guidelines for managing the reserves, and a glossary.

A. The Level of the Foreign Exchange Reserves

1. The level of the reserves and the changes in it

In 2017, Israel's foreign exchange reserves grew by $14.6 billion, from $98.4 billion at the end of 2016 to $113 billion at the end of 2017. The increase in the reserves this year was greater than the increase in the previous year (Figure 3), and occurred mostly in the first half of the year.

FIGURE 3: The Level of Israel's Foreign Exchange Reserves and the Ratio of the Reserves to GDP, 2008–17
($ billion, month-end balance)



Source: Bank of Israel

The increase in the reserves derived primarily from mark to market of $7.5 billion and from $6.6 billion in foreign currency purchases by the Bank of Israel (Table 2). The mark to market is the change in the dollar value of the reserves attributed to income from interest, capital gains, and exchange rate differentials against the dollar in currencies in which the reserves are invested. This year, due to the weakening of the dollar against the euro and the pound sterling, currencies in which approximately 30 percent of the reserves are invested, there were gains of $4.3 billion from exchange rate differentials of these currencies against the dollar were recorded in the reevaluation account. In addition to these gains there was income of $3.1 billion from interest and capital gains.

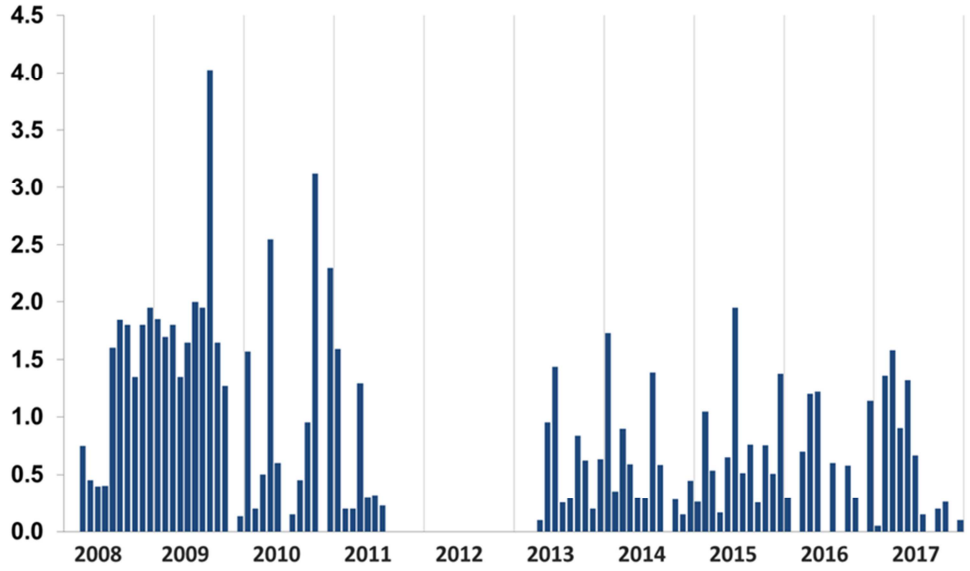
TABLE 2: Components of the Change in the Reserves, 2017
($ million)

FX Purchase	6,600
Mark To Market	7,476
Private Sector	24
Government	464
Total Change	**14,564**

Source: Bank of Israel

Purchases by the Bank of Israel this year were carried out as part of the Bank of Israel's monetary policy[5] and were slightly greater than purchases in 2016 ($6 billion) (see Figure 4).

FIGURE 4: Bank of Israel Foreign Exchange Purchases, January 2008–December 2017
($ billion)



Source: Bank of Israel

2. The appropriate level of the reserves

At the end of 2017, the level of reserves was slightly above the upper bound of the range of the appropriate level of reserves, $70–110 billion (Figure 3), as a result of actions taken as part of the Bank's monetary policy.

The appropriate level of the reserves is determined by the Governor of the Bank of Israel in accordance with the objectives of holding the reserves, based on the principles approved by the Monetary Committee (see Appendix 2—Principles for Determining the Appropriate Level of Foreign Exchange Reserves). These principles take into account the generally accepted international standards for assessing the adequacy of foreign exchange reserves and the potential uses of the reserves, such as financing imports, repaying debt, and intervening in the foreign exchange market during emergencies. The appropriate level of foreign exchange reserves is designed to enable the central bank to achieve the objectives of the public policy that were defined for it, and is perceived as a positive indicator of the country's economic and financial robustness.

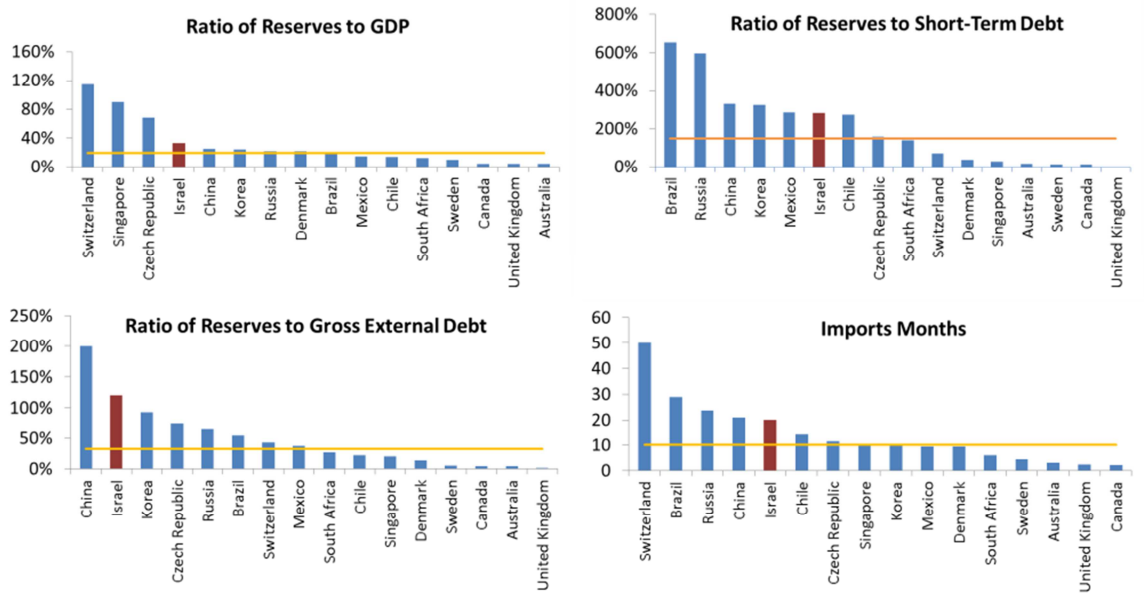
In some instances, the foreign currency reserves may deviate from their appropriate level for extended periods. The Bank of Israel's intervention in the foreign exchange market led to a deviation of the actual level of reserves from the appropriate level. Such a deviation is permitted under the Bank of Israel Law. In general, the Bank of Israel will take action to adjust the level of reserves to the appropriate level only when the deviation is significant and persistent, and only if such actions are consistent with attaining the Bank's objectives listed in the Bank of

[5] See Box on "Exchange rate policy at the Bank of Israel: Reasons, outcomes and decision-making process" available at http://www.boi.org.il/en/NewsAndPublications/RegularPublications/Pages/IMF201602h.aspx#

Israel Law—including price stability, support for other economic policy goals, and support for the stability of the financial system.

Looking at the generally accepted ratios of the reserves to economic aggregates, Israel's level of reserves is higher than the median of the ratios of other countries (Figure 5).

FIGURE 5: Ratio of the Reserves to Economic Aggregates, end of 2017, Israel vs. Selected Countries



Reserves levels as of December 31, 2017.
Source: Central Bureau of Statistics, IMF, World Bank, S&P, Bloomberg, Bank of Israel

B. The Framework for Managing the Foreign Exchange Reserves

1. Objectives of holding the reserves and the guidelines for managing them

According to the **Bank of Israel Law, 5770–2010**, one of the Bank's functions is to hold and manage the country's foreign exchange reserves. The Monetary Committee, headed by the Governor, and whose members include representatives of the public, was granted the authority to establish the **guidelines for the investment policy of the reserves** (Appendix 3), in consultation with the Minister of Finance, and to monitor the implementation of this policy. The Committee also approves and revises the allocation of responsibilities for the investment of the reserves between it and the Foreign Currency Committee and the Market Operations Department.

The **investment guidelines** include the specification of the assets, the risk profile, and the quantitative and qualitative limitations on types of assets permitted for investment. It should be emphasized that the guidelines do not constitute a recommendation for the actual proportion of investment in these assets. The actual proportion of investment is determined in a strategic allocation process, subject to the maximum level of risk set by the Committee, and based on assessments of the expected conditions in the relevant financial markets (see Section 3 of this chapter for further discussion of the allocation process).

Countries hold foreign exchange reserves for three main purposes:

- To provide the economy with sufficient foreign currency for an emergency situation (such as war or natural disaster). In such instances, it may be necessary to maintain imports or to rapidly increase them in order to deal with the emergency, while exports are liable to be negatively impacted, thus reducing the inflow of foreign currency. In these circumstances, the government and the private sector will find it difficult to raise foreign currency abroad, and the foreign exchange reserves will become the country's main source for financing in foreign currency.
- To enable the central bank to intervene in the foreign exchange market in the following circumstances: (1) the foreign exchange rate has deviated from the range that is consistent with the economy's fundamental equilibrium; or (2) the foreign exchange market is not functioning properly (market failure).
- To enable the central bank to operate in the foreign exchange market in order to moderate the effect of significant capital flows of either nonresidents or domestic residents, which are liable to undermine the stability of the financial markets, thereby negatively impacting the stability of the economy as a whole (a specific case of the previous function).

In order to achieve these goals, the investment of the reserves is carried out according to the following three basic principles:

- Maintaining the purchasing power of the reserves;
- Managing the reserves at a high level of liquidity;
- Achieving a suitable holding rate of return on the reserves portfolio, as long as this does not interfere with achieving the previous objectives (as detailed in Appendix 3—Foreign Exchange Reserves: Investment Policy Guidelines).

2. The maximum level of risk for the reserves

The maximum level of risk in the reserves portfolio (the risk profile) is set by the Monetary Committee according to its assessment of the appropriate risk, and is defined as the maximum loss in the reserves that the Committee is willing to accept, without adversely affecting the attainment of the objectives for which they are held. Its objective is to limit in advance the reserves' exposure to the various financial risks – price risk,[6] spread and credit risk, currency risk, and liquidity risk.

The risk measure **CVaRp (Conditional Value at Risk)** is used to quantify the level of risk. It measures the risk in terms of the expected loss on the investment portfolio in a specific time period and given a certain probability (p). It should be noted that **CVaRp** is an ex ante indicator, affected by changes in the portfolio holdings and the volatility of its assets, but is based on the past level of volatility.

In the guidelines, the Monetary Committee set the maximum level of risk for the reserves, so that given the worst 5 percent of possible outcomes, the average loss—the CVaR5%—would not be greater than 400 basis points. The Monetary Committee continually evaluates the conditions under which the level of risk was set, and is likely to change this level if material changes occur in these conditions.

At the beginning of every year, the Monetary Committee sets the **level of risk used to determine the strategic allocation for that year**, based on the expected macroeconomic and financial background conditions. At the end of 2016, the Committee chose to increase the maximum level of risk for 2017, from 300 basis points to 350 basis points, in view of its

[6] Price risk for bonds is the interest rate risk measured in terms of duration (the average lifespan).

assessment that the prevailing conditions in the markets were suitable for taking additional risk. The Committee selected an annual risk lower than the maximum in the guidelines (400 basis points) in order to leave a margin of safety for active management of the reserves and changes in the CVaR level due to change in the level of volatility in the markets.

3. The basic benchmark and the strategic allocation

The management of the Bank of Israel's foreign exchange reserves portfolio, like that of other investors worldwide, uses a **benchmark** as a reference point for measuring returns of investment decisions and risks taken by portfolio managers. A **benchmark** is a hypothetical portfolio composed of various investable assets and formulated according to known and fixed rules.

The **basic benchmark** represents a conservative composition of investable assets, which meets the first two goals of the investment policy for the reserves—maintaining their purchasing power and managing them with a high level of liquidity. In order to achieve its objectives, the basic benchmark is composed of selected short-duration, high-rated government bonds with a high degree of liquidity and the same currency composition as the numeraire. Until March 2014, the benchmark's duration was identical to that of the reserves portfolio. Shortening the duration of the benchmark in 2014 resulted in an increase of the spread between the basic benchmark return and the return on the reserves portfolio.

The **numeraire** is a basket of currencies consisting of three currencies, whose weights were distributed on average over the year, as follows: dollar—67.6 percent, euro—29.9 percent and pound sterling—2.5 percent. The numeraire's composition is derived from the possible uses of the reserves and the principles that reflect the objectives of holding those reserves. The holding rate of return on foreign exchange reserves is measured in terms of the numeraire, so that from the point of view of the reserves portfolio manager, its composition is considered to be risk-free. The composition of the numeraire is reviewed at least once a year and revised when necessary with the approval of the Monetary Committee. The numeraire is defined quantitatively (a quantity-based currency basket) so that its composition varies daily in line with changes in the exchange rates of its currencies.

An annual strategic allocation process in the reserves portfolio determines the composition of the portfolio for the coming year. The strategic composition of the reserves portfolio is determined so that the expected return on the portfolio is adequate, within the framework of the desired risk level and the guidelines' constraints. In the strategic allocation process, the expected economic and financial environments are estimated, and their effects on the prices of the assets, as well as the optimal portfolio composition based on those effects, are assessed.

It relies on a broad range of data and on statistical models, and therefore involves a degree of uncertainty. Beyond the results of the models, judgment is used when choosing the allocation based on a sensitivity analysis of the models' results and stress scenario analysis. **The strategic allocation determines the main characteristics of the reserves portfolio**, including the currency composition, the asset composition, and the target duration for each currency benchmark.

In the framework of the strategic allocation for 2017, the Committee decided to increase the investment in equities to 12.5 percent, to increase the investment in corporate bonds to 8 percent—of which, to diversify 1.5 percent to corporate bonds in Europe and the remainder to the US—and to lengthen the duration of the reserves portfolio from 18 months to 21.6 months.

It should be noted that **the Monetary Committee allows degrees of freedom for investment of the reserves**, so that the actual composition is likely to differ to some extent from that which was set in the allocation framework. Within the framework of these degrees of freedom, the share of investment in equities increased to 13.3 percent at the end of the year, and the share of investment in corporate bonds decreased to 6 percent.

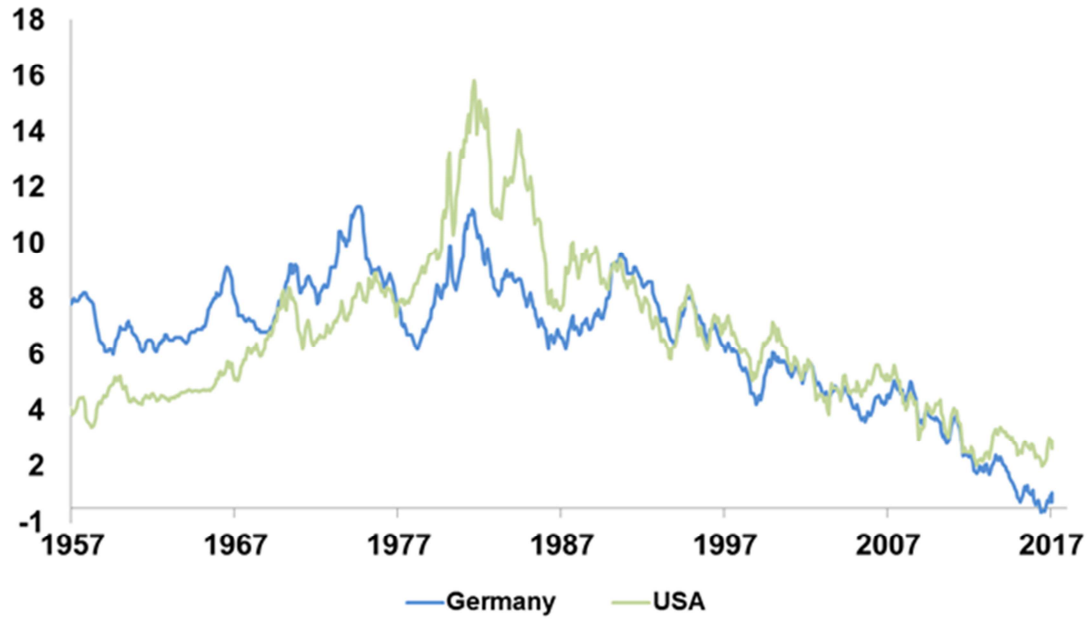
C. The Holding Rate of Return on the Reserves

1. Economic and financial background conditions

The rate of worldwide growth accelerated this year, yet the inflationary environment remained moderate despite the economic improvement. Monetary policy remained accommodative this year, and central banks in Europe and Japan continued to purchase assets. In contrast, the US continued a gradual normalization of its monetary policy, and the ECB also announced a more moderate level of purchases beginning from 2018. The improvement in the macroeconomic environment, the accommodative monetary policy, and moderate inflation rate supported asset prices and capital market prices, which continued to benefit from positive investor sentiment, high liquidity, and low volatility this year. Equities indices rose sharply and government bond yields remained low (Figure 6), as curves flattened, corporate bond spreads narrowed, and risk indices stayed at low levels, despite various geopolitical events that took place over the year. Equities increased as a result of increased corporate profitability and expectations for a tax reform in the US, which was approved at the end of the year. This year, despite the widening interest rate gap in favor of the dollar, the dollar weakened against most currencies against the backdrop of investors' rising risk appetite and the economic improvement in Europe and in other economies outside the US.

Appendix 1 presents a more detailed analysis of the economic and financial environment.

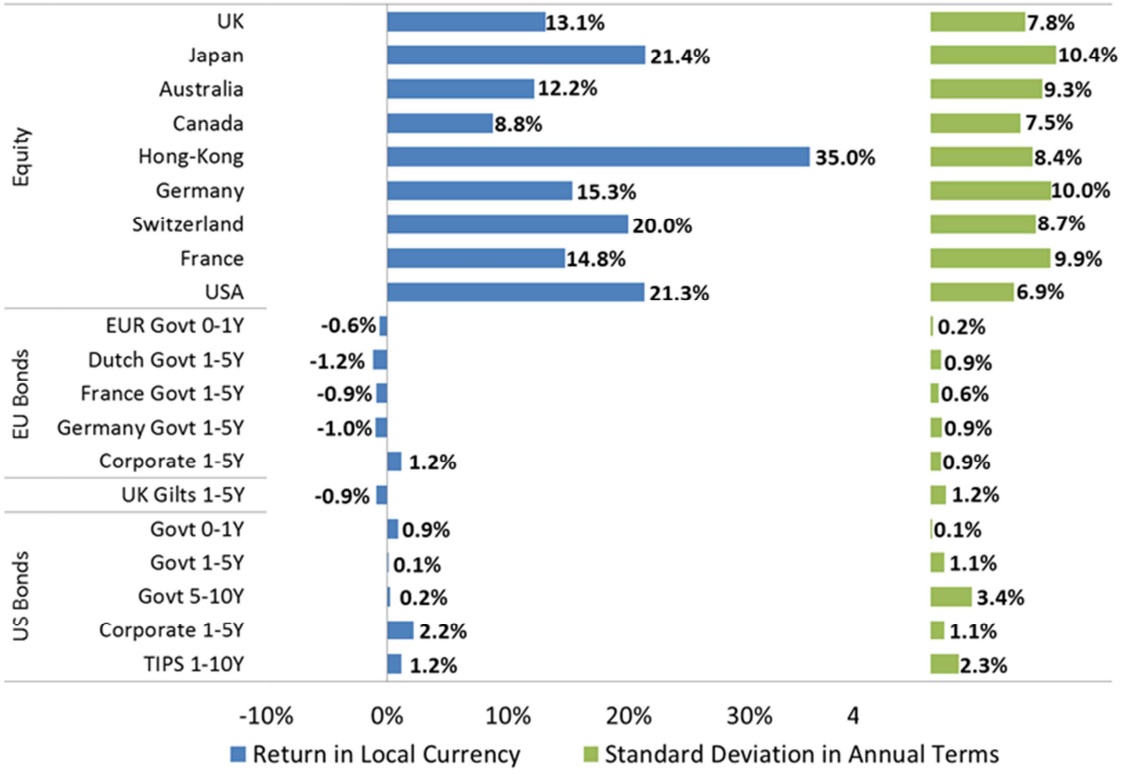
FIGURE 6: Ten-year Government Bond Yields—US and Germany, 1957–2017
(percent)



Source: Bloomberg

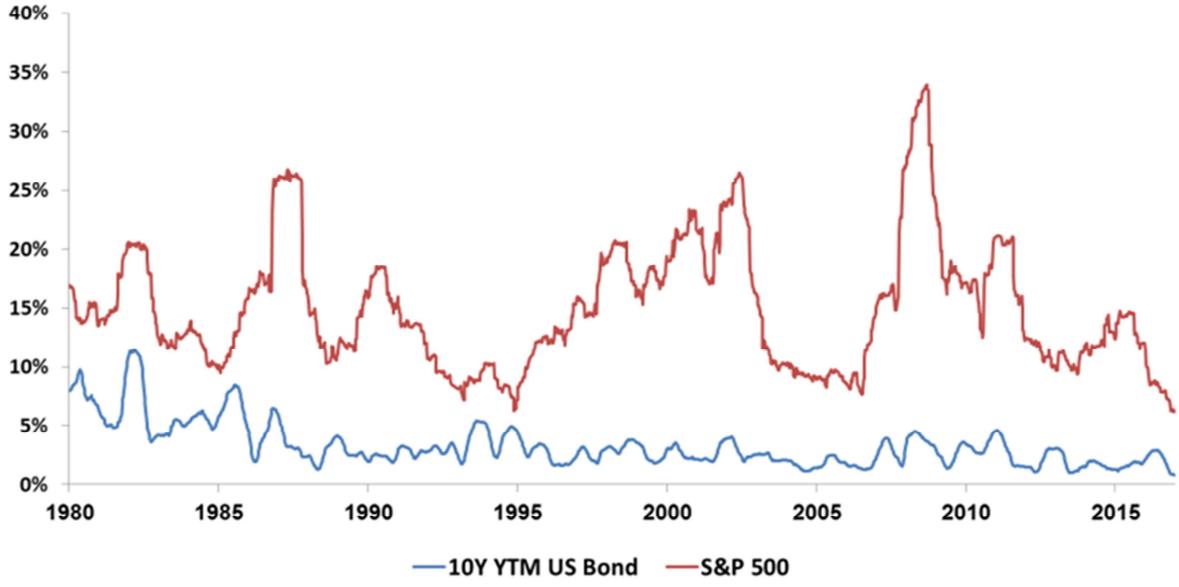
In 2017, most of the assets that the Monetary Committee approved for investment had positive returns, but there were negative returns on investment in European government bonds (Figure 7 — returns in local currency terms). The assets that generated the highest returns in 2017 were equities in Hong Kong, the US, and Japan. Corporate bonds also generated a solid return, though it was markedly lower than the return on equities. European bonds, in which a third of the total reserves is invested, recorded negative holding rates of return. The volatility (standard deviation) of equities was greater compared to other assets, as expected, but considerably lower than volatility in the preceding year (Figure 8), and the lowest in recent decades.

FIGURE 7: Holding Rates of Return and Standard Deviation for Indicators of the Main Assets in the Reserves Portfolio, 2017



*Includes interest, dividends, and capital gains/losses.
Source: Bank of Israel, Bloomberg

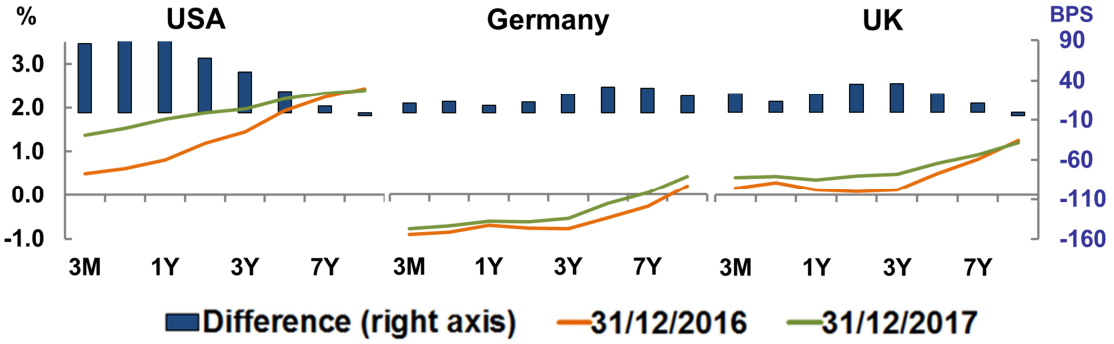
FIGURE 8: Standard Deviation of the S&P 500 Index and of 10-Year US Treasury Notes, 1980–2017



*Weekly standard deviation of the return on the S&P500 and of the yield to maturity on 10-year US Treasury Notes, in annual terms, 1-year moving average.
Source: Bank of Israel, Bloomberg

Yield to maturity, the total return when bonds are held to maturity, increased slightly in all the markets this year—the US, Europe, and the UK (Figure 9).

FIGURE 9: Change in Yield Curves, Government Bonds of US, Germany, and UK, 2017
(basis points)



Source: Bloomberg

In retrospect, the forecast for the macroeconomic environment and for returns on financial assets, which the Monetary Committee used in its strategic allocations this year, was similar to the actual course of economic and financial development though with different intensity. The global growth rate was surprisingly favorable, especially in Europe, and so was the absence of inflation. On the financial side, equities returns surprised to the upside, as did corporate bond returns, to a lesser extent. In the US, the increase in returns was smaller than expected.

Numerous risks identified at the beginning of the year had only a limited effect—Brexit, the risk of the dissolution of the European Union due to elections in various countries and in Catalonia, and concerns regarding growth in China and sections of its financial system. This year, volatility was significantly lower than in the past.

2. Return on the reserves portfolio

The holding rate of return on the reserves portfolio in 2017 was the highest since 2009. The return was 3 percent in numeraire terms, and the return on the basic benchmark was 0.3 percent (Table 3). The return was achieved under persistent conditions of low yields to maturity. This year, the volatility of the portfolio was lower than in the preceding two years, despite the increasing proportion of risk assets in the portfolio.

TABLE 3: Reserves Portfolio Performance vs. the Basic Benchmark, 2008–17
(Percent, in numeraire terms)

	Performance		Excess Return
	(1)	(2)	(1)-(2)
	Actual Portfolio	Basic Benchmark	Total
2008	**5.95**	**6.14**	**-0.19**
	(1.42)	(1.46)	(0.53)
2009	**1.91**	**0.81**	**1.10**
	(0.60)	(0.65)	(0.22)
2010	**1.73**	**1.19**	**0.54**
	(0.57)	(0.36)	(0.53)
2011	**1.28**	**1.07**	**0.21**
	(0.80)	(0.39)	(0.71)
2012	**1.59**	**0.42**	**1.17**
	(0.57)	(0.17)	(0.52)
2013	**0.87**	**0.07**	**0.80**
	(0.80)	(0.16)	(0.74)
2014*	**1.28**	**0.22***	**1.06**
	(0.85)	(0.09)	(0.88)
2015	**0.64**	**0.10**	**0.54**
	(1.29)	(0.12)	(1.29)
2016	**1.56**	**0.21**	**1.35**
	(1.33)	(0.13)	(1.33)
2017	**3.03**	**0.30**	**2.73**
	(0.80)	(0.01)	(0.77)

In parentheses – the standard deviation of weekly returns in annual terms.
*In March 2014, the basic benchmark's duration was shortened from 10 months to 6 months, and acted to increase the spread between the benchmark return and the reserves portfolio return.
Source: Bank of Israel

3. Multiyear return on the reserves portfolio

The high volatility of the risk assets relative to government bonds exacerbates the effects of the timing of entry into an investment and of the return's measurement period. A stronger effect is obtained when the return is measured on an annual basis. The increased proportion of the reserves portfolio invested in risk elements in recent years strengthens these effects, and increases the interest in **measuring the multiyear return**, which weakens the importance of the timing of the investment and its measurement.

The average multiyear return on risk assets is expected to be positive, but risk assets are inherently volatile, and losses should be expected in certain years, especially during a crisis. A focus on multiyear measurement is likely to moderate the pressure to reduce holdings at such times (also see Box 1 on the investment in equities).

The three-year average holding rate of return on the reserves portfolio increased this year to 1.74 percent in numeraire terms (Table 4). The **active management** return also rose, reaching 154 basis points. The relatively high returns and contribution this year pulled the three-year return upward. The three-year **risk level** was similar to that of the preceding year.

TABLE 4: Portfolio Return and Active Management Contribution, Annual and 3-Year Periods

	Return		Active Management Contribution	
	Annual	3-year, annual terms	Annual	3-year, annual terms
2013	**0.87** (0.80)	**1.25** (0.70)	**0.80** (0.74)	**0.72** (0.60)
2014	**1.28** (0.85)	**1.25** (0.74)	**1.06** (0.88)	**1.01** (0.66)
2015	**0.64** (1.29)	**0.93** (1.04)	**0.54** (1.29)	**0.80** (1.01)
2016	**1.56** (1.33)	**1.16** (1.09)	**1.35** (1.33)	**0.98** (1.09)
2017	**3.03** (0.80)	**1.74** (1.06)	**2.73** (0.77)	**1.54** (1.06)

In parentheses - the standard deviations of the returns in annual terms.
Source: Bank of Israel

D. Active management contribution

The contribution of active management is mainly the contribution of the decisions to invest in additional assets and countries not included in the basic benchmark, or with a different duration and diversification. Active management can be classified into four main risk categories—duration, equities, credit spread assets, and currency and other exposures.

In recent years, the active management contribution has had the greatest effect on the return on the reserves portfolio, while the return on the basic benchmark has been low and stable. Increasing the risk elements in the portfolio increases the long-term expected return, as a result of the **risk premium—**the surplus return on risk assets in excess of the risk-free interest rate—inherent in them. At the same time, a potential increase in the volatility of active management contribution is also expected. The volatility is also influenced by the correlation between the assets in the portfolio.

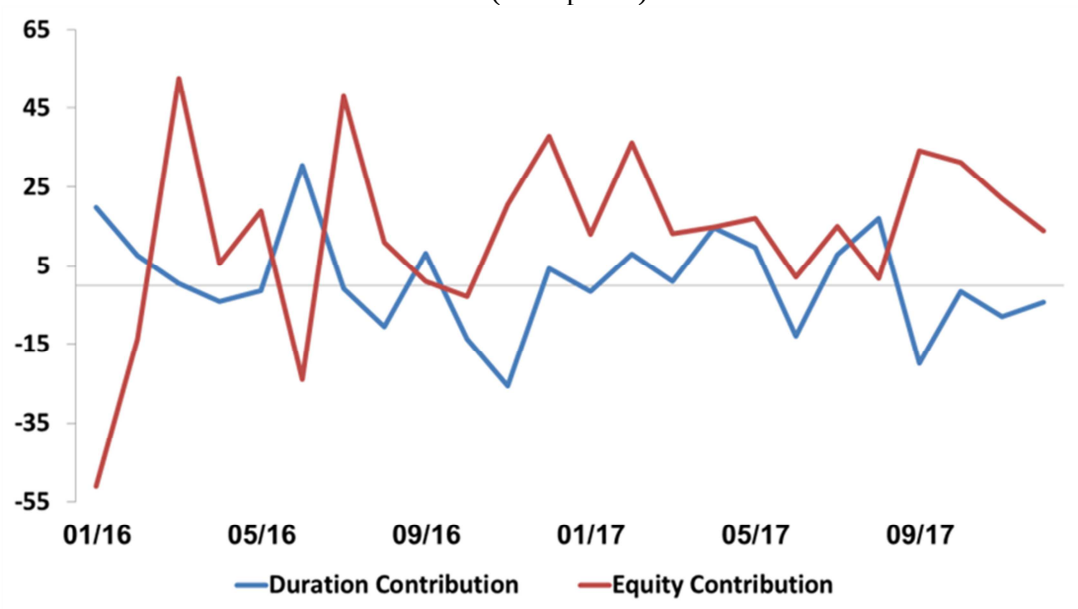
The duration risk-premium is the return for increasing the interest rate risk inherent in bonds. The premium derives from the upward sloping structure of the yield curve, and is obtained with certainty only when a bond is held until maturity. During the lifespan of a bond, the holding rate of return is subject to the risk of capital losses resulting from an increase in yields; the longer the bonds' duration, the greater this risk. The contribution of portfolio duration management in the reserves portfolio derives from the decision to invest the reserves in instruments of a greater duration compared to the duration of the basic benchmark.

The risk premium of equities is obtained when the equities are held for a long period, but the premium shows high volatility for one-year horizons. It therefore follows that the investment in equities is a long-term investment with high volatility, which is liable to generate losses in the short term (also see Box 1: Investment of foreign currency reserves in equities).

The typically negative correlation between government bonds and equities has the effect of reducing the active management risk, and this effect was notable at the end of the year. Despite their greater risk, in some cases long-duration bonds may reduce the overall risk of the portfolio, as they are negatively correlated with the return on equities—especially when equities prices drop sharply or during a crisis, as a result of flight to quality. The duration and equities components were increased in the framework of the strategic allocation, based on the assumption that combining them helps reduce the volatility of the return on the reserves portfolio: in a scenario of increasing yields to maturity, capital losses will be offset by income from equities, and vice versa.

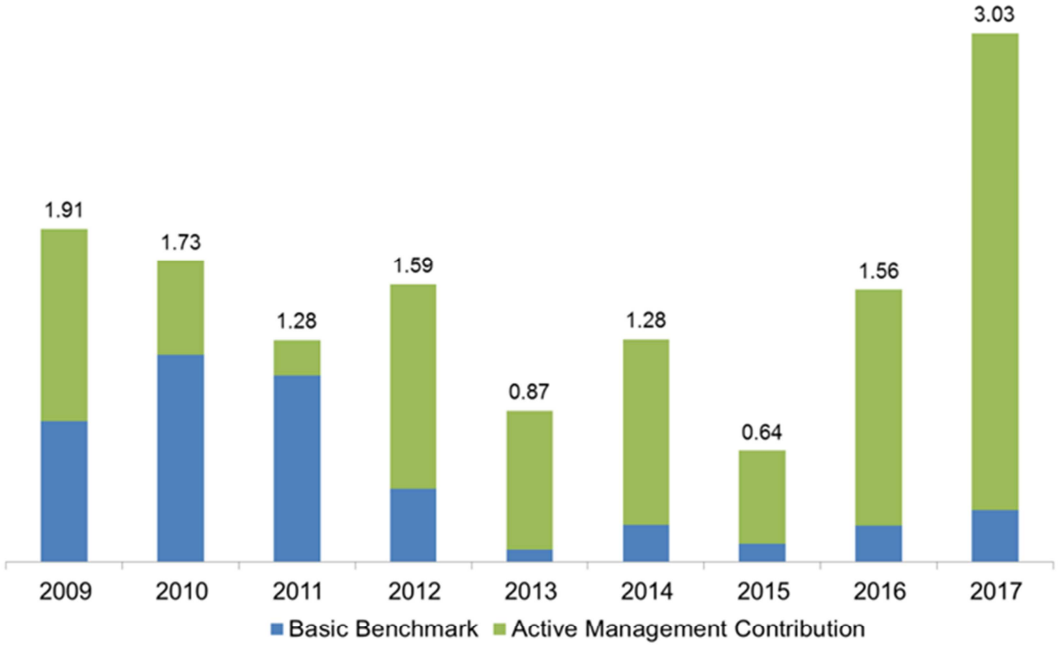
Nonetheless, early this year, this correlation was not notable because no periods of significant volatility were recorded in the markets (Figure 10). During most of the year, equities rose in a relatively steady manner, with limited fluctuations, and yields to maturity recorded no significant correction. In September, however, markets showed sharper fluctuations, during which the contribution from duration declined and the contribution from the equities rose correspondingly.

FIGURE 10: Contribution of Equities and of Duration in the Reserves Portfolio, from 2016 through 2017
(basis points)



Source: Bank of Israel

FIGURE 11: Rate of Return: Basic Benchmark, Reserves Portfolio and Active Management Contribution, 2009–17
(percent, in numeraire terms)



Source: Bank of Israel

This year, active management contributed 273 basis points above the return on the basic benchmark, compared with 135 basis points in the preceding year (Table 3)—the greatest contribution in the past decade (Figure 11).

Of the risk assets, equities generated the major portion of the contribution to active management — 219 basis points (Table 5). The duration and other spread assets contributed an additional 56 basis points. Of the spread assets, the contribution of investment in short-term assets and the contribution of corporate bonds were most prominent this year.

TABLE 5: Breakdown of Active Management Contribution to its Components, 2015–17
(basis points, in numeraire terms)

	2015	2016	2017
Equity	31	94	219
Duration & Diversification	12	19	19
Spread assets	9	29	37
Currency and asset exposures	3	-7	-1
Total	**54**	**135**	**273**

Source: Bank of Israel

1. Equities

The reserves' investment in equities began in 2012. It tracks domestic equity indices in the investment markets (Also see Box 1: Investment of foreign currency reserves in equities).

Since 2017, the diversification of investment in equities among markets has been based on a broad-based index of equities in advanced economies (based on the MSCI Developed Markets Index). Until that change was introduced, investments in equities were made in a gradual manner, in various major economies, which have the required level of liquidity. The aim of the change was to closely track an accepted investment benchmark in the market, thereby maintaining the relative stability of the equities portfolio invested in a number of economies.

The contribution of the investment in equities in 2017 was 219 basis points, which is relatively high compared to the contributions of other risk components (Table 5). This contribution can be traced to two factors: Early in the year, the Monetary Committee decided to increase the investment in equities, and by the end of the year equities accounted for 13.3 percent of portfolio compared to 10 percent at the end of 2016 (Table 6). In addition, major equity markets increased at higher than expected rates (Figure 7 and Figure A-3 in Appendix 1).

In the course of the year, the proportion of investment in various markets was modified (Table 6). Diversification of investment was extended to the equity markets in Australia and Canada, and changes were also introduced as a result of the transition to the new equity index. Investments in equities in markets that are not denominated in numeraire currencies are hedged against the effects of changes in the exchange rate of the dollar against those market currencies. This is similar to other investments in non-numeraire currencies, which are also hedged to prevent unintended exposure to these currencies.

The largest contribution was recorded in the US, followed by Japan. The contribution is a result of the weight of investments in a specific market and changes in the equity index in that market. The largest portion of this investment, 7.3 percent at end 2017, was invested in the US equity market, which, together with a 21 percent increase in prices, resulted in a high contribution of 125 basis points (Table 6). The contribution of the investment in Japan, 28 basis points, was solid and resulted from an increase in the equity index there, which was similar to that of the US markets.

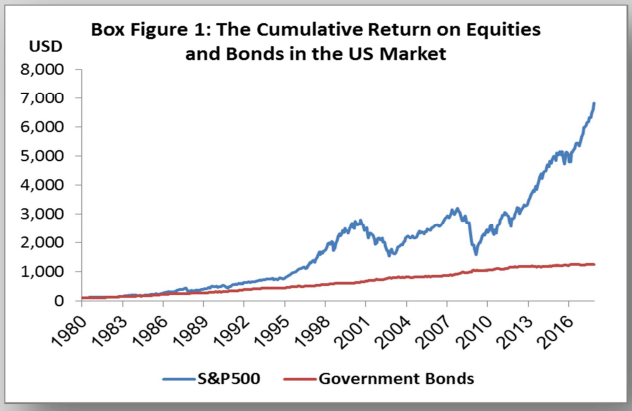
TABLE 6: Holding Percentage in Equities by Country, and the Contribution to the Reserves Portfolio in 2017

	Holding Percentage		Equity Contribution
	End of 2016	End of 2017	(b.p)
Australia	0.0%	0.3%	2
UK	0.4%	0.9%	10
US	4.4%	7.3%	125
Germany	3.0%	0.9%	17
Hong Kong	0.2%	0.3%	8
Japan	0.7%	1.8%	28
France	0.6%	0.9%	16
Korea	0.3%	0.0%	2
Canada	0.0%	0.5%	3
Switzerland	0.5%	0.4%	8
Total	**10.0%**	**13.3%**	**219**

Source: Bank of Israel, Bloomberg

BOX 1: The investment of foreign currency reserves in equities

In 2012, the Bank of Israel decided to begin to invest a portion of the foreign currency reserves in equities in foreign countries. This decision was facilitated by: (a) **the new Bank of Israel Law**, which allowed investment in a broad range of financial assets, including equities~~,~~ that were not permitted under the old law; (b) **the sharp rise in the reserves,** which allowed a portion of the

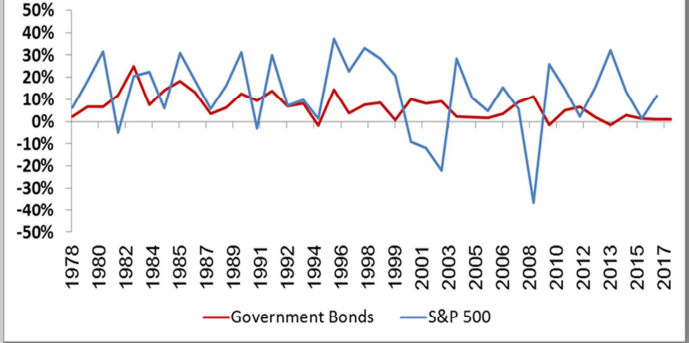


Source: Bloomberg

reserves to be invested with a longer horizon. The higher the level of the reserves, the larger the cushion available to absorb losses, which makes it possible to invest in more volatile assets such as equities and, in the long term, to benefit from the risk premium inherent in such assets. The main motivations for investing in equities are: (a) **to increase risk diversification**—due to the negative correlation between government bonds and equities, an investment of a specific portion of the reserves in equities can be expected to moderate the portfolio's risk; (b) **to improve the returns on the reserves portfolio**, against the backdrop of the sharp decline in interest rates and government bond yields in advanced economies, which reached record lows.

Empirical findings indicate that over the long term, the investment in equities generates an excess return over the investment in government bonds. For example, an investment of one dollar in the US equity index S&P500 generated a cumulative[7] return of $6,800 since 1980, compared to a cumulative return of merely $1,200 on a one dollar invested in US treasury bonds[8] (Figure 1). In the short term, the return on an investment in equities is much more volatile than an investment in government bonds and therefore investment in equities is riskier (Figure 2). For example, in the past 70 years, US equity market investments generated a negative return of 12% once every five years, on average. The longer the investment horizon, the greater the worth of investing in equities, as the proportion of cases in which a negative return is generated declines. For example, in the past 70 years an investment in equities with an investment horizon of 10 years generated a negative return only two times.

Box Figure 2: The Return on Equities and Bonds in the US Market

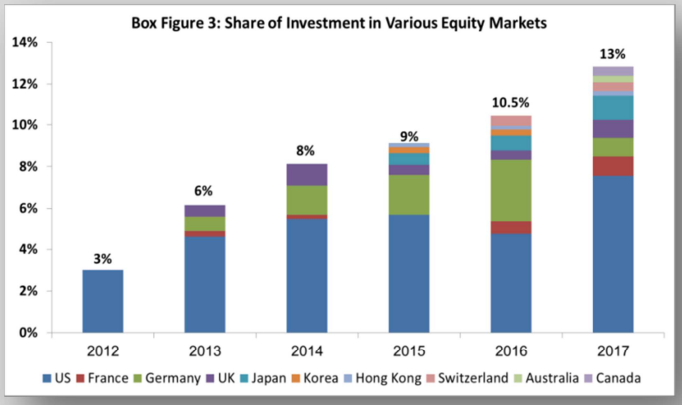


Source: Bloomberg

The Bank of Israel's decision to invest a portion of the foreign currency reserves in equities was based on a long-term perspective. The short-term investment risk is managed as part of the risk management of the portfolio as a whole, such that at any point in time, the average loss of 5 percent of the worst observations is not expected to exceed 4 percent, for an investment horizon of one year.

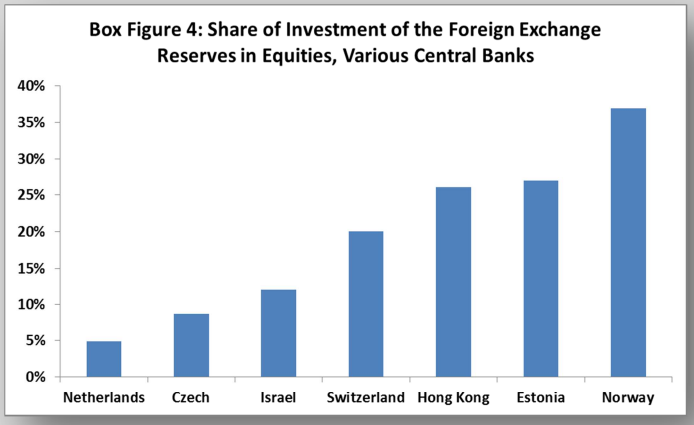
[7] Returns include dividends.
[8] With maturities of 1–10 years.

To diminish the timing effect and to allow a learning process, the entry into the equity market was gradual. In 2012, the Bank of Israel invested 3 percent of the reserves in the US equity market, and this proportion increased over time; diversification to additional markets was also gradual. Currently, the Bank invests 13 percent of the reserves in the equity markets of 9 countries[9] (Figure 3). The proportion of the investment in equities is determined once a year by the Monetary Committee, as part of the Committee's strategic allocation of the reserves portfolio. The strategic composition of the reserves portfolio is selected with the aim of maximizing the expected return on the portfolio within a horizon of one year, subject to the risk profile and assessments of the macroeconomic environment and expected financial conditions.



Source: Bank of Israel

The Bank of Israel is not the only central bank that invests a portion of its foreign currency reserves in equities, but it was one of the first to do so (Figure 4). The characteristic shared by most of the central banks that invest in equities is a high ratio of reserves to GDP. In recent years, the number of countries that are considering investing in equities is on the rise. According to recent surveys among central banks, approximately 30 percent are considering beginning investment in equities in the near future.

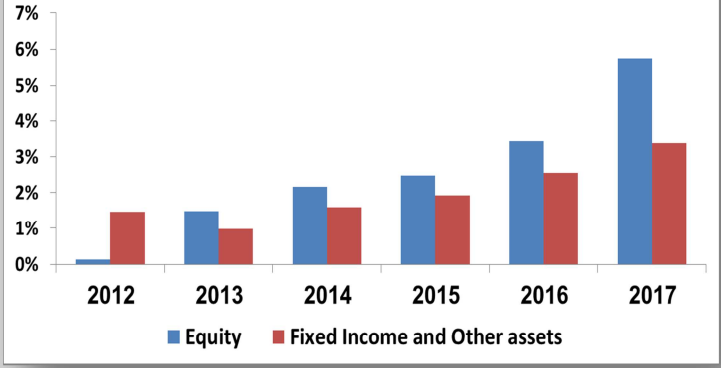


Source: Surveys of central banks, 2016-17

[9] The largest nine equity markets of the advanced economies.

The investment in equities made a significant contribution to the return on the reserves portfolio, although it accounted for a relatively small share of the portfolio. The cumulative contribution of the investment in equities to the return on the foreign currency reserves portfolio since 2012 amounts to 64 percent of the cumulative return in this period, which totaled 9.2 percent (Figure 5). Considering the relative scope of the investment, it can be stated that the cumulative contribution of each one percent of the reserves invested in equities since 2012 was 64 basis points, 18 times greater than the cumulative contribution of each percentage of the reserves invested in bonds and other financial instruments, which was just 3.6 basis points. Consequently, without an investment in equities, the cumulative return on the reserves portfolio would have totaled a mere 3.6 percent, compared to the portfolio's actual cumulative return of 9.2 percent.

Box Figure 5: Cumulative Contribution of Investment Components to the Reserves Portfolio Return



Source: Bank of Israel

These figures indicate that the investment in equities increased the portfolio's cumulative returns by more than two-fold in the past 6 years. The considerable contribution by investment in equities stems from the substantial worldwide increases in equity prices recorded in recent years. As the equity markets are typically cyclical (negative annual returns once every 5 years, on average) some decline in prices can be expected in the future, which will generate losses for the reserves portfolio. Empirical findings indicate that the ability to predict the behavior of equity market is limited and therefore it is almost impossible to predict the timing of a decline in prices. Nonetheless, the returns accrued on the investment in equities in recent years constitute a safety cushion to absorb unexpected losses caused by declines in equity markets, even if the markets decline very sharply. For example, assuming the current share of investment in equities (13 percent), the cumulative contribution of equities to the foreign currency reserves portfolio will become negative only if the equity markets record a negative return of more than 36 percent. For the sake of comparison, the return on the US equity market in 2008 was -37 percent and equities prices corrected a substantial portion of this drop as early as in 2009.

In summary, in the long term, investment in equities generates excess returns and contributes to the greater diversification of risk in the portfolio, but in the short term such investment is volatile and therefore relatively risky. The investment in equities contributed considerably to the reserves portfolio returns due to the rising equity prices in recent years. As equity markets are typically cyclical in nature, it is reasonable to expect a drop in prices in the future, yet due to the limited ability to predict the behavior of equity prices, it is almost impossible to estimate the precise timing of a drop in prices. Nevertheless, in the long term, the investment in equities is expected to contribute to the returns on the reserves portfolio.

2. Duration and diversification

The duration of a fixed-income portfolio is an accepted measure for estimating the interest rate risk to which the portfolio is exposed. The contribution of duration and asset diversification is a function of the decision to invest the reserves at a duration that differs from that of the basic benchmark, and the decision to disperse the assets differently on the curve compared with the basic benchmark. In maintaining a longer duration, the portfolio usually benefits from a higher current return than that of the basic benchmark, generating capital gains when yields are falling and capital losses when yields are rising.

The contribution of duration and diversification was 19 basis points this year. The portfolio's duration averaged 19 months in 2017, compared with 17 months in the preceding year and compared with the duration of the basic benchmark, which was 6 months. The contribution derived from the current return, and despite some rise in the yield curves of numeraire currencies (Figure 9). The major portion of the contribution stemmed from the decision to increase the duration of the dollar portion of assets in the strategic asset allocation compared to the basic benchmark (10.9 basis points). Diversification of the investment on the curve in the euro portion of the portfolio also made a further significant contribution of 7.2 basis points.

The yield curve in the US rose and flattened in late 2017; the short term yield to maturity rose toward the end of the year, against the backdrop of the continued rising interest rates in the US, while the long term end increased to a lesser degree and remained similar to its level at the end of 2016. In 2017, the long term yield declined due to the moderation in inflation and in the long-term inflation expectations, yet rose again toward the end of the year against the backdrop of political concerns in the US and advances in the US tax reform. In Germany and the UK, curves also rose somewhat compared to the preceding year. In the UK, curves flattened somewhat, while in Germany curves became steeper. In the first half of the year, yields in Europe declined due to the continued accommodative monetary policy, but in the second half of the year, prospects increased for a less accommodative monetary policy, and yields rose, especially in the long end of the curve. In the UK, Brexit had a more moderate effect than expected.

3. Spread assets

Spread assets are debt instruments, such as corporate bonds, that are not included in the basic benchmark. The return of these assets is greater than that of government bonds with a similar term to maturity. The spread on the return reflects mainly a credit risk premium that exceeds the

credit risk premium of government bonds, and varies according to the level of the asset's credit risk.

The overall exposure to various spread assets and additional exposures contributed 37 basis points. The investment in short-term spread assets in the dollar portfolio was notable this year again and accounted for the majority of the contribution of this component, 22.4 basis points. The investment in spread assets generated excess returns, mainly due to the high current returns of these assets, which exceeded the current returns of the basic benchmark (short-term government bonds). These assets were mainly variable rate bonds, synthetic assets (investments in short-term bonds not denominated in dollars, hedged through currency swap transactions), and commercial paper.

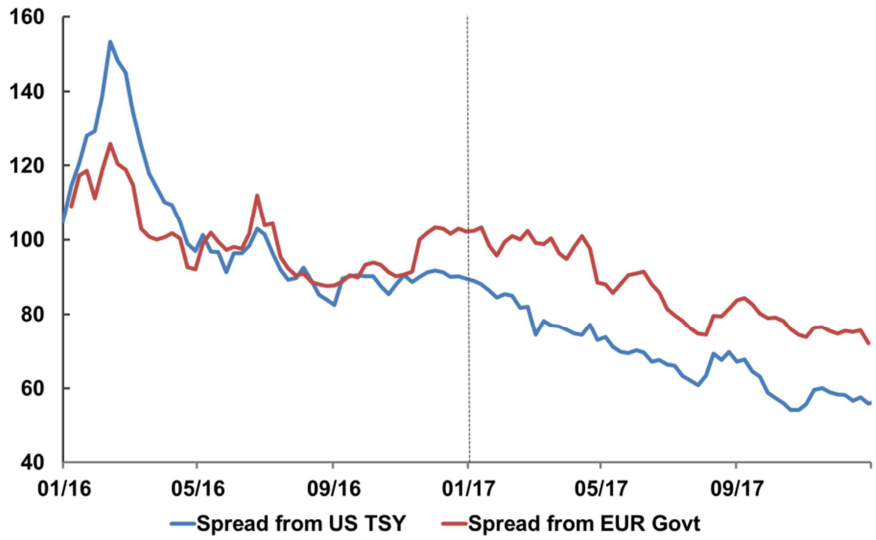
The exposure to corporate bonds contributed 10.3 basis points. The main spread risk in the reserves portfolio derives from the investment in investment-grade corporate bonds traded on the US and European markets. The investment is carried out by means of both internal and external management. It is managed actively, subject to specific degrees of freedom for management, vis-à-vis a known benchmark with broad coverage of the US and European corporate bond market. The share of the reserves portfolio invested in corporate bonds was increased in early 2017 to 7.5 percent, and was reduced to 6 percent at the end of the year, against the backdrop of narrowing spreads. This year, for the first time, 1 percent of the foreign currency reserves was invested in corporate bonds traded in Europe.

The contribution of the corporate bonds to active management stemmed mainly from the excess current return of approximately 70 basis points above US Treasury bonds, an increase in the portfolio during the year, and a significant reduction in the spread, compared with the beginning of the year.

The yield spread between corporate bonds and government bonds narrowed gradually over the year, with little fluctuation, from 90 basis points to 60 basis points at the end of the year (Figure 12). The yield spread for European bonds declined from 100 basis points to 70 basis points. The background to the continued narrowing spreads this year was excess liquidity in the markets, an improvement in corporate profits, and continued bond purchases by the ECB.

FIGURE 12: Spreads of US and European Corporate Bonds in the 0–5 Year Benchmark over Government Bonds, 2016–17

(basis points)



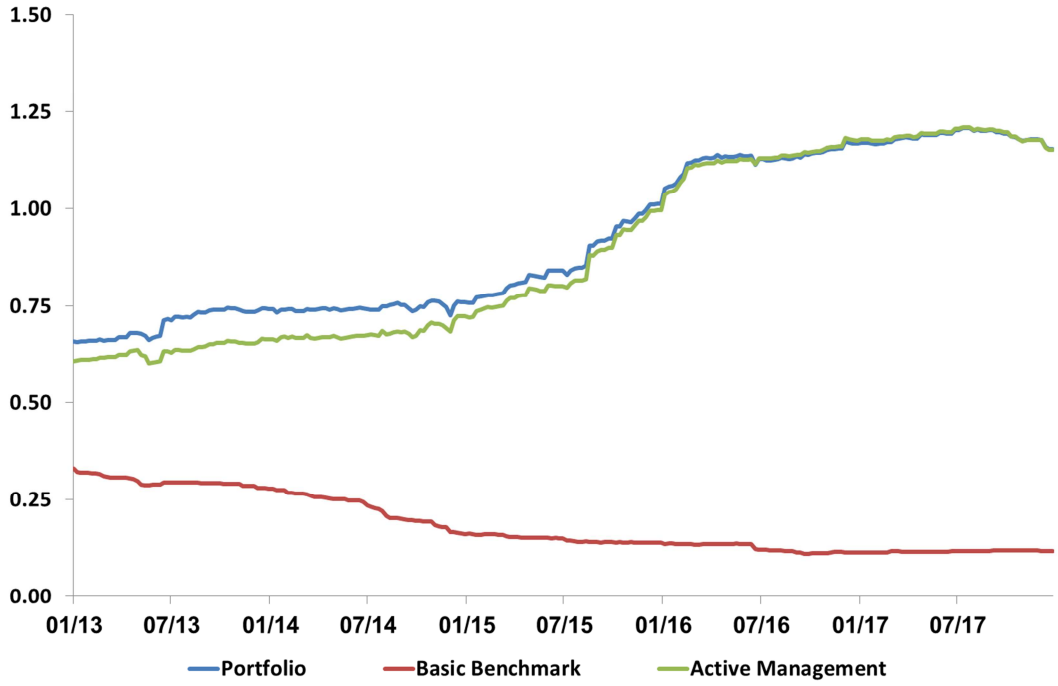
Source: Barclays

E. Measures of risk and risk-adjusted returns

1. Volatility of the reserves portfolio, active management, and the CVaR measurement

In recent years, the risk in the reserves portfolio has increased, due to the growing proportion of risk assets under active management. This year, in contrast, portfolio volatility declined due to the unusually low level of volatility in the financial markets (Figure 13). The risk in the reserves portfolio is mainly a function of the active management contribution and the low and stable benchmark risk, which has been gradually declining.

FIGURE 13: Standard Deviation[10] of the Basic Benchmark, the Reserves Portfolio and the Active Management Contribution, 2013–17
(3-year moving average, percent)



The volatility of the reserves portfolio and of active management was relatively low this year (0.8 percent) (Table 3)**.** The returns on most assets increased or remained stable this year, and the changes in them were moderate. This was reflected in reduced volatility. The volatility of the basic benchmark declined slightly and remained low, as in preceding years (0.1 percent), as expected in view of the conservative composition of its assets.

In 2017, the CVaR5% of the portfolio was lower than the maximum level set in the strategic allocation, and was relatively stable around 320 basis points. The low level was caused by the low volatility that prevailed in the markets this year.

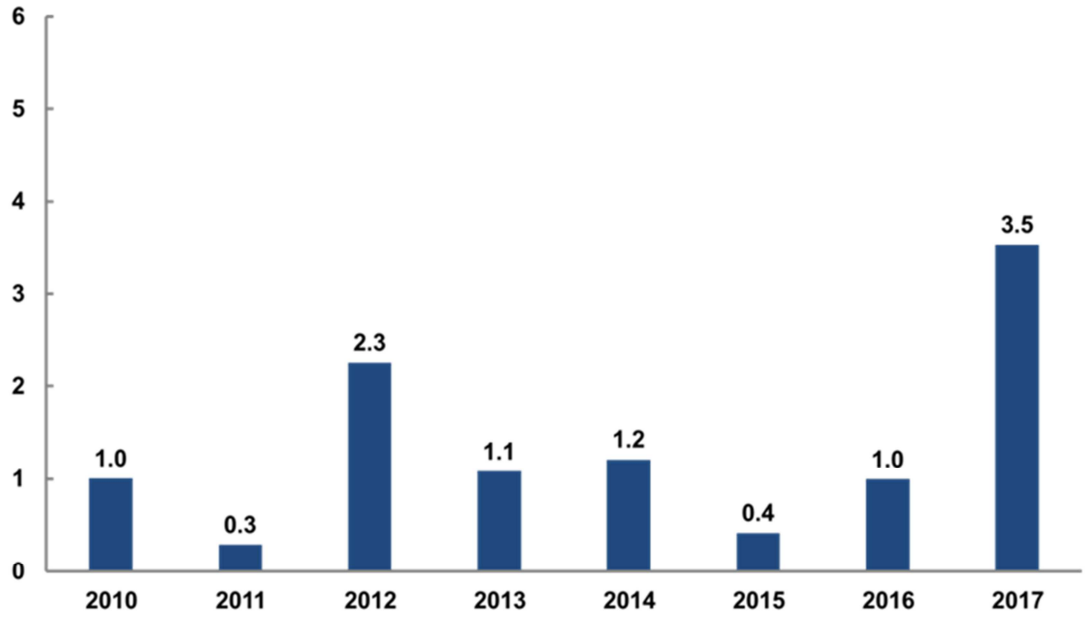
2. The risk-adjusted contribution of active management

The **Information Ratio (IR)** measures the **active management** of the portfolio manager (the excess returns), relative to the risk taken, and indicates the degree of consistency in the manager's ability to generate excess returns on additional risk. The risk is calculated as the ratio of the contribution of active management to its standard deviation.

[10] Standard deviation of weekly returns in yearly terms.

This year, the investment in risk assets was especially worthwhile in view of the combination of low volatility and high returns. The risk-adjusted return, measured by the IR, increased sharply this year due to the combination of the high contribution of active management and the low volatility in the markets (Figure 14).

FIGURE 14: The Ratio of Active Management Contribution to its Standard Deviation—the Information Ratio, 2010–17



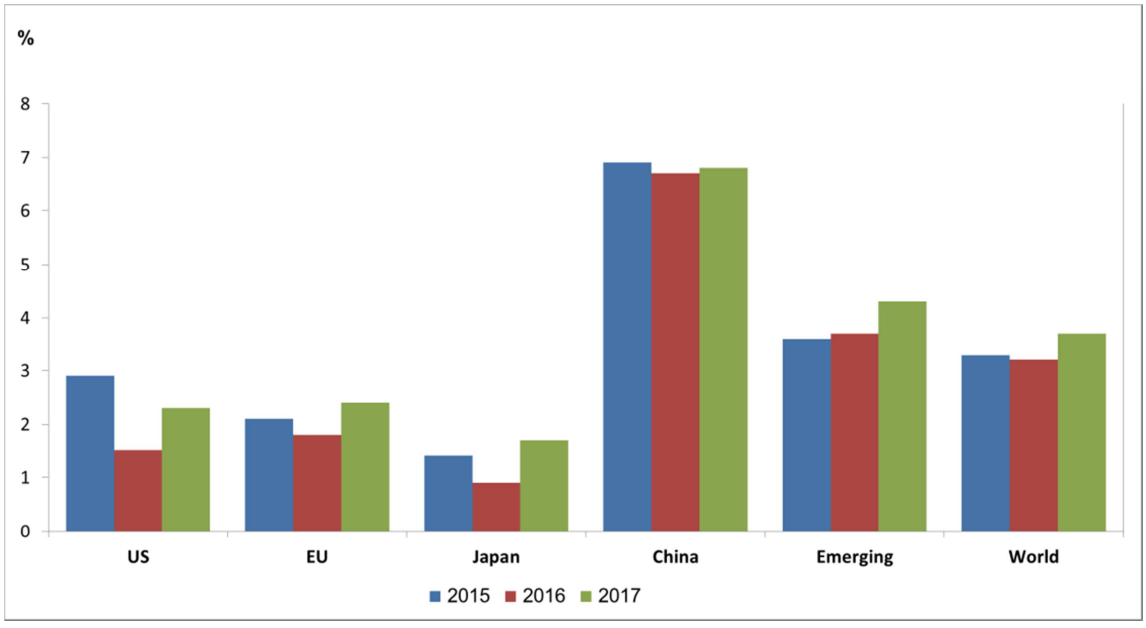
Source: Bank of Israel

Appendices

Appendix 1
The Global Economic and Financial Environment

The global pace of economic growth accelerated from 3.2 percent to 3.7 percent this year[11], with an improvement in growth in both advanced and developing countries (Figure A-1). Growth of world trade continued to recover, industries and investments in the developed markets gradually improved, and business and consumer sentiment indices reached high levels. Despite the economic improvement, the inflationary environment remained moderate in most developed economies (Figure A-2). Monetary policy remained accommodative this year, with low and even negative interest rates in some economies, as the central banks in Europe and Japan continued in their acquisition of assets. In contrast, a gradual normalization of monetary policy continued in the United States, with three interest rate increases in the course of the year, and the beginning of a contraction in the Fed's balance sheet toward the end of the year. Other central banks (Canada and UK) raised interest rates this year and the ECB also announced a slower pace of acquisitions beginning in 2018.

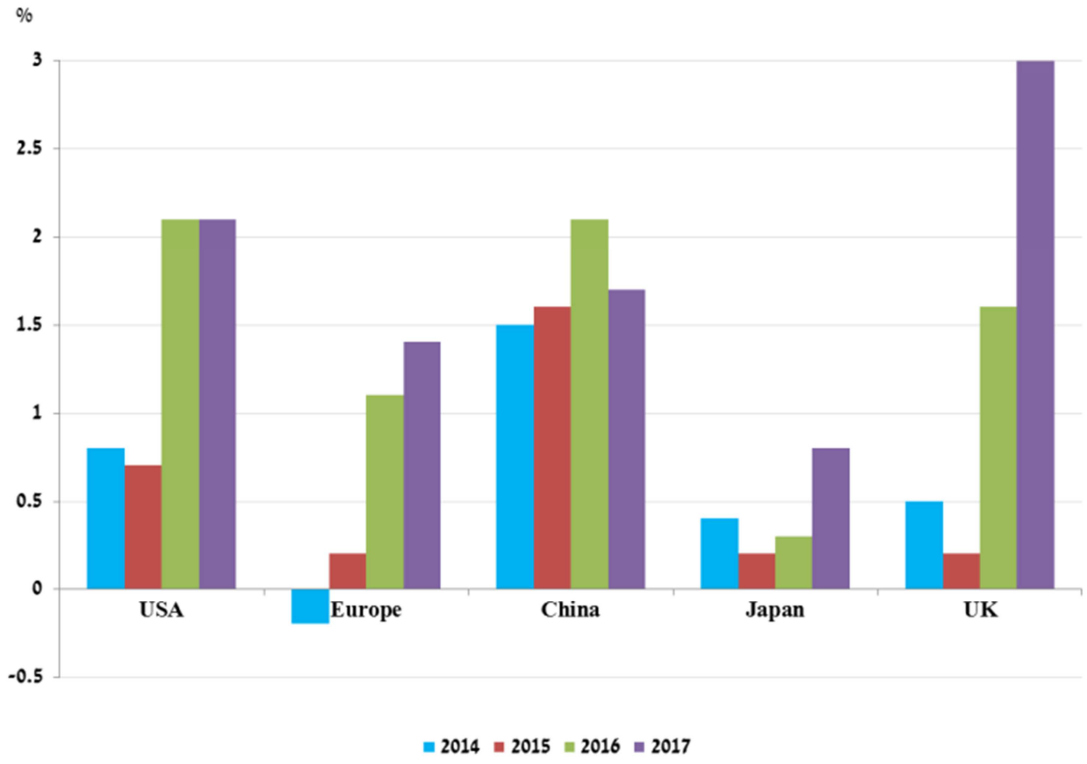
Figure A-1: Annual Growth by Major Countries/Blocs
(percent)



Source: World Bank

[11] The following growth data are based on "Global Economic Prospects" by the World Bank, January 2018.

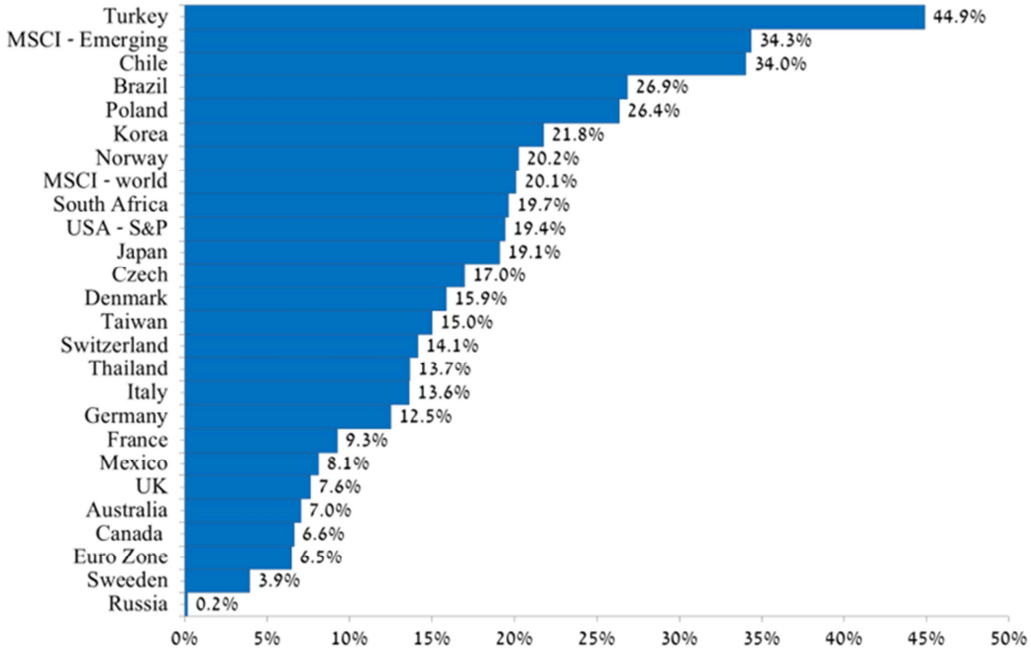
Figure A-2: Annual (CPI) Inflation in Major Blocs
(percent)



Source: Bloomberg

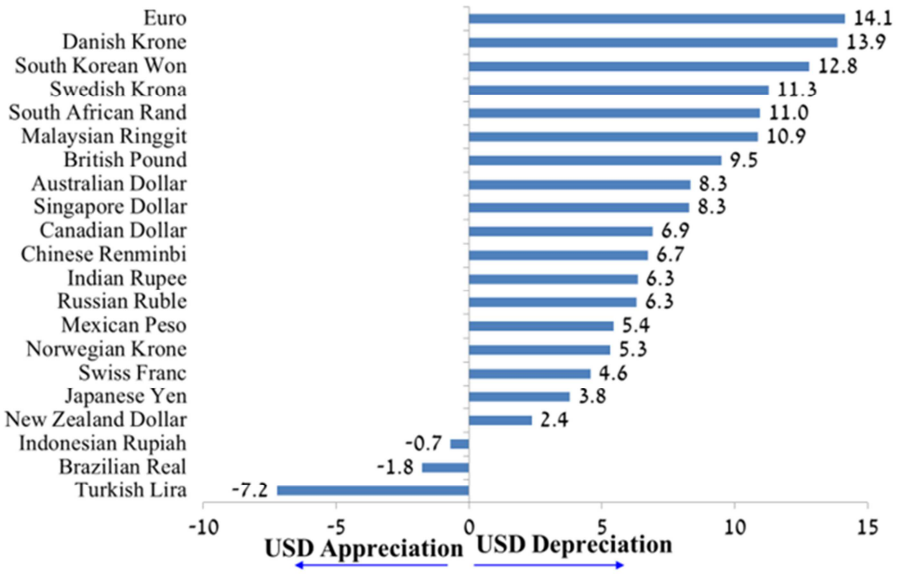
The improvement in the macroeconomic environment, the accommodative monetary policy, and the moderate inflation all supported asset prices and the capital markets, which continued this year to benefit from favorable investor sentiment, high liquidity, and low volatility. Equity markets worldwide rose sharply this year, especially in the developing economies (Figure A-3). Government bond yields remained low, with flattened curves in several countries (US, UK, Canada); corporate bond spreads narrowed; and risk indices remained low, despite geopolitical events during the year. This year, the dollar weakened against most currencies, in light of rising investors' risk appetite and the economic improvement in Europe and other economies outside the US, and despite the increase in the interest rate gap between the dollar and other major currencies (Figure A-4). Oil prices rose as a result of the extension of the oil production cut agreements between Russia, OPEC, and other oil-exporting countries; weather-related events in the US; weakening of the dollar; and geopolitical tension in the Middle East.

Figure A-3: Equity Returns in Local Currency Terms, 2017



Source: Bloomberg

Figure A-4: Performance of Major Currencies vs. the Dollar, 2017

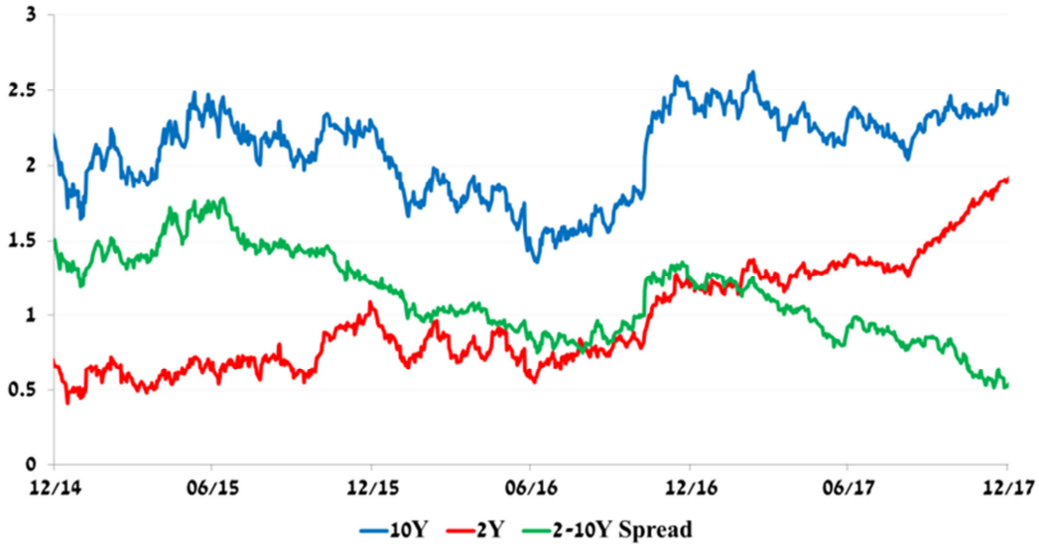


Source: Bloomberg

The US economy accelerated this year, driven by private consumption and an improvement in investments. The equity market rose sharply, led by technology stocks and supported by the positive momentum in global growth, improvement in the state of corporations, and the expected implementation of the US administration's tax reform, which passed late in the year.

Short-term government yields rose as a result of increases in the federal funds rate by the Federal Reserve. Long-term yields declined over the first three quarters of the year, affected by moderation in inflation and in long-term inflationary expectations, yet rose once again in the fourth quarter against the backdrop of increased expectations of implementation of the tax reform and an increase in the deficit and the beginning of a contraction in the Fed's balance sheet. The yield curve flattened sharply (Figure A-5).

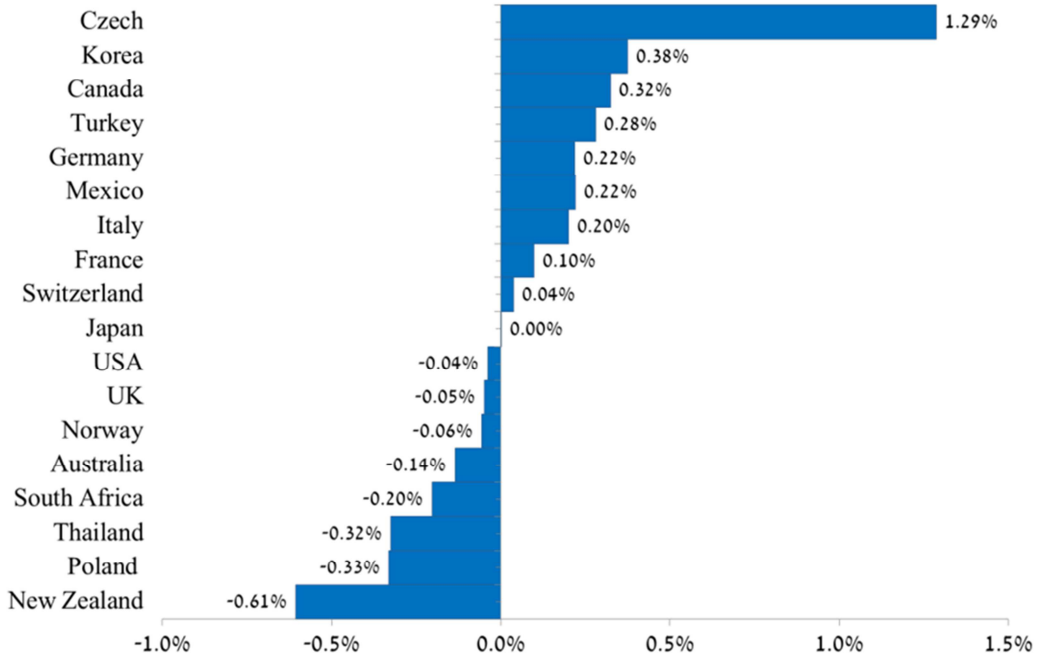
Figure A-5: Government Bond Yield for 10 Years and for 2 Years, and the Slope of the Curve in the US
(percent)



Source: Bloomberg

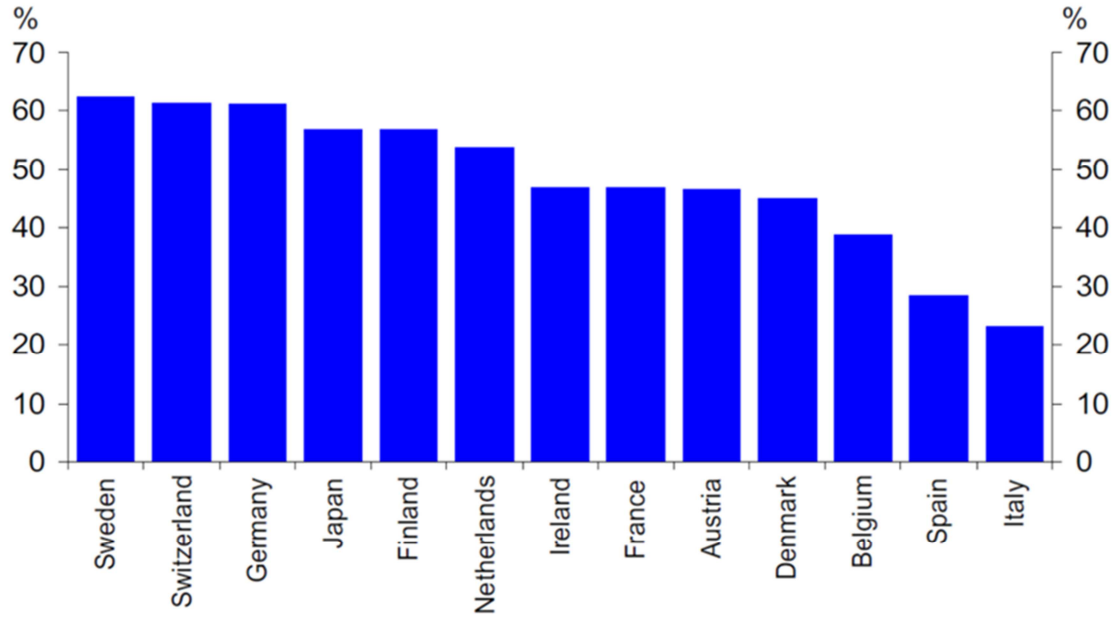
The European economy gained momentum and presented a significant improvement in its rate of growth, seen in most of the economies in the eurozone. Equity markets in the eurozone rose this year, led by Germany and Italy, and were supported by an improvement in economic activity, an accommodative monetary policy, and the dissipation of concerns regarding the materialization of political risks. Equities performance was, however, relatively modest compared to other equity markets (US and Japan) as a result of the sharp strengthening of the euro. Long and short government bond yields rose this year, in both the core and the peripheral countries (Figure A-6), against the backdrop of an improvement in economic activity and contraction of the central bank's acquisition program. Nevertheless, a large proportion of government bonds—though smaller than last year—continued to trade at a negative interest rate (Figure A-7). The **UK economy** slowed this year against the backdrop of the uncertainty surrounding Brexit, and the moderation in real wages and private consumption. Despite the slowdown, the central bank raised interest rates in November in order to moderate the inflation rate. The British pound strengthened against the backdrop of the interest rate hike and increased anticipations for a Brexit agreement.

Figure A-6: Changes in Yield to Maturity on 10-Year Notes in Major Countries, 2017



Source: Bloomberg

Figure A-7: Percent of Government Bonds Trading at Negative Interest Rate



Source: DB

Japan's economy accelerated this year, thanks to a gradual improvement in consumer spending and corporate investments, supported by accommodative monetary and fiscal policy. External demand also strengthened, against the backdrop of the improved global macroeconomic environment. The equity market benefited from the positive momentum in the economy and rose sharply this year. Long-term yields remained around zero, due to the central bank's policy of acquisitions and control of the central bank's yield curve.

Emerging economies' growth rate also improved significantly, especially against the backdrop of recovery of growth rates of the energy and commodity exporters (Russia and Brazil). Equities of emerging economies outperformed those of developed economies, against the backdrop of sustained improvements in the economies and in investors' sentiments, and an increase in risk appetite. In **China**, growth remained stable, with the assistance of fiscal incentives and improved exports, while investments continued to slow down, as part of the long-term structural reform of the economy.

Appendix 2
Principles for Determining the Desired Level of the Foreign Exchange Reserves

1. The appropriate level of foreign exchange reserves as an indicator of the economic strength of the country

Countries hold foreign exchange reserves for three main purposes:

A. To enable the central bank to intervene in the foreign exchange market in circumstances in which (1) the exchange rate deviates from the range that is consistent with the economy's fundamental equilibrium; or (2) the foreign exchange market is not functioning adequately (market failure);

B. To enable the central bank to operate in the foreign exchange market in order to moderate the effect of large capital flows from either foreign or local residents, which are liable to undermine the stability of the financial markets, and thus negatively impact the stability of the economy as a whole (a specific case of A);

C. To allow for the provision of sufficient foreign currency to the economy in an emergency situation (such as a war or a strong earthquake). In such circumstances, there will be a need to increase imports rapidly and by a significant amount in order to deal with the emergency, while exports may also be adversely affected and therefore this source of foreign currency will also be reduced. Under such circumstances, the government and the private sector will find it difficult to raise foreign currency abroad and the foreign exchange reserves will be left as the country's main source for financing in foreign currency.

Therefore, holding an appropriate level of foreign exchange reserves is considered by local and foreign financial institutions, companies, households and rating agencies as a main indicator of a country's economic resilience. The larger a country's foreign exchange reserves are, the greater the ability of policy makers to deal with unavoidable economic and political pressures. Furthermore, large foreign exchange reserves tend to reduce the rates of interest paid both by the government and by the private sector for financing from abroad. In short, in the eyes of the financial markets and of individuals, foreign exchange reserves at an appropriate level make an important contribution to the confidence in a country's ability to deal with economic, financial and political shocks to the economy.

2. There are various approaches to the calculation of the appropriate level of foreign exchange reserves:

a. *Relative to import months*: For most of the post-World War II period, the appropriate level of foreign exchange reserves was measured in terms of "import months"—the number of months of imports that the reserves would be able to finance. This approach dominated as long as international capital flows were

limited, and the main source of difficulties in foreign exchange was the current account of the balance of payments.

b. *Relative to capital flows*: During the 1990s, it became clear that many financial crises were caused by large-scale capital flows, that is, disruptions in the capital account, rather than by disruptions in the current account of the balance of payments. At the end of the 1990s, wide use was made of the Greenspan-Guidotti rule, according to which a country's foreign exchange reserves should be at least as much as the country's foreign currency liabilities (of both the public and private sectors) during the coming twelve- month period, thus allowing a country to deal with a complete cutoff from sources of foreign currency for a period of one year. The 100 percent rule (according to which the reserves must be equal to the full amount of foreign currency liabilities for one year) was based on an empirical study—how countries survived the financial crises of the 1990s and early 2000s: it was found that countries which operated according to the 100 percent rule were prone to fewer foreign currency attacks, and were better able to deal with them.
   During the global crisis which began in 2007 it became clear that countries which held foreign exchange reserves exceeding 100 percent were better able to deal with the crisis. The main examples are Brazil, Russia, and South Korea. Each of those countries held foreign exchange reserves that exceeded 100 percent of their foreign exchange liabilities, and they used them effectively to stabilize the exchange rate and/or to maintain financial stability. It is currently recognized that foreign exchange reserves of between 100 percent and 200 percent of an economy's foreign currency liabilities are more effective than a reserves level which meets the Greenspan-Guidotti rule precisely.

c. *Relative to potential uses in the future (the eclectic approach)*: In calculating the appropriate level of foreign exchange reserves for Israel, the Bank of Israel adopted the eclectic approach, which is based on the potential uses of the reserves in an emergency. Clearly, in a time of national emergency, Israel will likely require reserves, both to finance imports (according to the import months approach, including imports of goods and services related to the emergency situation) as well as to deal with capital flows – payments of existing debts to foreign residents, with potential capital flows.

Based on the range of factors listed above and in accordance with the current conditions in Israel's economy, the Governor revised the desired level of reserves to a range of $70–110 billion.[12]

Additionally, in setting the level of foreign exchange reserves, the cost of holding the reserves[13] was taken into account. However, in terms of a risk-reward analysis of

[12] The Governor updated the range in the beginning of 2015 from the range of $65–90 billion that was set in 2010, and which had remained unchanged since then. The increase in the range of the desired level of reserves is consistent with the changes that occurred in the Israeli economy over the past 5 years.

[13] The accounting cost of the Bank of Israel's activity is recorded in the Bank's general ledger. At the same time, the Bank's accounts do not include the expected profit (in terms of stability of the economy) derived from the expected use of the reserves in various situations in the future, nor that derived from market assessments that larger reserves contribute to the economy, as described above.

holding the reserves, it is difficult to measure quantitatively the advantages and benefits of holding them. The contribution of the reserves to the economy cannot be quantified and priced, among other reasons because their contribution may be critical in emergency situations whose nature and severity are difficult to predict.

3. Israel's actual level of foreign exchange reserves

Implementing the eclectic approach, which takes into account both the need to import goods and services as well as the potential capital flows related to a crisis situation, must take into account Israel's unique geopolitical situation, which requires a higher level of reserves relative to economic variables which are generally taken into account when calculating the appropriate level of foreign exchange reserves.[14]

4. Intervention in the foreign exchange market and the appropriate level

It is important to note that, as explained in Section 53 of the Bank of Israel Law, the intervention of the Bank of Israel in the foreign exchange market, in order to fulfill its functions and attain its objectives, may lead to a deviation in the actual level of the reserves from their desirable level. Government and banking system activity can also lead to such a deviation. In general, the Bank will act to change the level of the reserves only when the deviation is significant and prolonged, and only if such action is in line with attaining the Bank's objectives as established in the Bank of Israel Law, which include maintaining price stability, supporting other economic policy goals, and supporting the stability of the financial system. Thus, the foreign currency reserves could deviate from the desired level for extended periods of time.

[14] For a discussion on the ratios of the actual reserves to economic variables and a comparison with other countries, please see Section 4 of Chapter B of this report.

Appendix 3
Foreign Exchange Reserves: Investment Policy Guidelines

Foreign Exchange Reserves: Investment Policy Guidelines[15]

In effect from September 26, 2016

In accordance with Section 40(b) of the Bank of Israel Law, 5770-2010, the Monetary Committee is to establish the guidelines for the investment policy of the foreign exchange reserves.

1. **Basic guidelines derived from the goals of holding the reserves**
   The investment policy of the reserves portfolio is based on the main goal of achieving the Bank of Israel's objectives and proper fulfillment of its functions as they are detailed in the Bank of Israel Law. Subject to that, the investment policy is also based on the following goals:

   a) **Maintaining the purchasing power of the reserves:** This principle is interpreted as preserving the value of the reserves in terms of measurement currency chosen by the Bank—the numeraire (see 3 below).
   b) **Managing the reserves with a high level of liquidity:** A large part of the reserves are to be invested in assets that can be liquidated rapidly at short notice and without negatively impacting their value. The precise level of liquidity is to be increased to the extent that the actual level of reserves relative to the desired level is low (5(e) below).
   c) **Achieving an appropriate return on the reserves portfolio,** at an acceptable level of risk, to the extent that it does not negatively impact the achievement of the previous goals (see 4 below).

2. **The division of work between the Monetary Committee, the Foreign Currency Committee, and the Markets Operations Department**

In implementing Section 40(b) of the Bank of Israel Law, the Committee made a distinction between establishing the guidelines and periodic monitoring, and setting the detailed instructions for the day to day management of the portfolio.

The Monetary Committee will set the guidelines, in consultation with the Minister of Finance as established by law, will update the guidelines to the extent necessary, and will monitor the implementation of the investment policy by the Markets Operations Department.

The Foreign Currency Committee—an internal Bank of Israel committee headed by the Governor—will translate the guidelines into the detailed foreign exchange reserves investment policy.

[15] The characteristics of the reserves portfolio are reported to the public in an annual report published on the Bank of Israel website.

The Market Operations Department will implement the investment policy, within the framework of degrees of freedom which will be set periodically by the Monetary Committee and the Foreign Currency Committee, and will report to the Monetary Committee and the Foreign Currency Committee on a quarterly basis on the implementation of the policy: developments in international markets and their impact on the management of the reserves, the investment decisions reached by the Department, the portfolio's rate of return, and the financial and other risks to which the portfolio is exposed.

The Market Operations Department will advise the Monetary Committee and the Foreign Currency Committee on fulfilling their functions, through position papers and suggestions for discussion in the Committees.

The Monetary Committee will approve and update periodically the division of authorities regarding the investment policy of the foreign exchange reserves.

3. The measurement currency for the holding rate of return on the foreign exchange reserves and the principles for its determination

The measurement currency for the holding rate of return on the reserves—hereinafter, the numeraire—is a basket of currencies and its composition allocation[16] is decided by the Monetary Committee. The allocation of the numeraire is set according to principles which reflect the goals of holding the reserves.

The principles according to which the composition of the numeraire is set are:

a) The currency composition of actual imports, and of imports expected in an emergency situation
b) The composition of the short and medium term external debt
c) Assessments regarding the liquidity of the various currencies in which investment is possible.

The composition of the numeraire is also examined from the perspective of the currency composition of foreign exchange reserves portfolios of all central banks of countries that are IMF members, as reported by the IMF.

The composition of the numeraire will be set at the end of each year by the Monetary Committee, on the basis of the Market Operations Department’s recommendation, in accordance with changes in domestic and global market conditions. If there are significant

[16] The numeraire is defined in terms of units of currency (i.e., X dollars, Y euro, and Z pound sterling). The ratio between the currency units (in the above example, X:Y:Z) is determined by the currency composition of the portfolio (in the above example, % of dollars in the portfolio, % euro, and % pound sterling), which is set by the Committee and the exchange rates of the numeraire currencies at the time of the decision.

changes in one or more of principles (a)–(c), the composition of the numeraire will be brought to discussion by the Monetary Committee.

The reserves portfolio holding rate of return is measured in terms of the numeraire, so that the currency basket which makes up the numeraire is seen by the reserves portfolio managers as a risk-free currency composition.

4. The risk profile

The risk profile determines the maximum level of risk that the Monetary Committee is willing to accept in order to achieve the goals of holding the reserves. In establishing the risk profile, scenario analysis and a range of analytical tools to measure risk, such as VaR, CVaR, and others should be used. The risk profile is to be set by the Committee on a periodic basis in accordance with the changing conditions in the global capital markets.

The risk profile will be set so that given the worst 5 percent of outcomes, the average loss will not be greater than 400 basis points over a 1-year horizon.

5. The rules for managing the financial risks of the reserves

The rules for managing the financial risks to which the reserves are exposed, and their asset allocation, are to be set in accordance with the goals of the investment policy of the reserves (Section 1 above) and subject to the risk profile set by the Monetary Committee (Section 4). The asset allocation of the foreign exchange reserves will be approved at least once a year by the Monetary Committee.

a) The types of assets approved for use in managing the reserves are:

1. Bonds (including bonds with fixed interest, with variable interest, and CPI-indexed bonds)
2. Mortgage-backed securities (MBS) and asset-backed securities (ABS), a maximum of 6 percent of total reserves
3. Tradable Certificates of Deposit (CDs)
4. Fixed term deposits
5. Commercial Paper (CP)
6. Equities, a maximum of 15 percent of total reserves
7. Derivatives whose underlying asset is permitted for investment.

b) Management against a benchmark

Control over most features of the financial risk of the reserves is anchored in their management against a system of benchmarks. The rules for managing the financial risks of the reserves generate the currency allocation of the benchmarks, the features of their price

risk (such as duration) in each currency, and the asset types included in it. The investment returns of the portfolio managers are measured against these benchmarks.

c) Currency risk:

The currency exposure of the reserves is set by:

1) The composition of the numeraire.
2) Strategic currency exposures relative to the composition of the numeraire: The extent of the strategic currency exposures is limited to 10 percent of total reserves. The composition and amounts of the exposures will be set by the Monetary Committee.
3) Short and medium term currency exposures relative to the composition of the numeraire: Their amount is limited to 2 percent of the total reserves. The composition and amounts of the exposures will be set by the Market Operations Department.

d) Credit risk:

In order to limit the credit risk inherent in day-to-day management of the reserves portfolio, the Monetary Committee set the following rules:

1. Investment is permitted in the currency of countries whose major credit rating category is at least BBB. Investment in currencies of countries whose credit rating category is BBB is limited to 1 percent of the total reserves and requires the specific authorization of the Monetary Committee.
2. Investment is permitted in bonds and commercial paper issued by governments, or with government guarantees, if their major credit rating category is at least a BBB rating. Investment in the BBB major rating category is limited to 1 percent of total reserves, and requires the specific authorization of the Monetary Committee.
3. Investment in bonds of public sector entities (PSE) is limited to a maximum of 15 percent of total reserves, and only in bonds whose major credit rating category is at least A.
4. Investment in corporate bonds is limited to 15 percent of total reserves, and only in bonds whose major credit rating category is at least BBB.
5. Investment in bonds and deposits of international financial institutions is limited to 15 percent of the reserves.
6. The exposure of the reserves to the international banking system should not be greater than 10 percent of total reserves, and that is only to banks and brokers whose major credit rating category is at least A. Activity with banks and brokers whose major credit rating category is BBB is limited to DVP[17] (delivery versus payment) alone.

[17] DVP activity is when the payment and the asset are transferred between the sides at the same time and thus the credit risk in such activity is essentially zero.

e) *Liquidity risk:*
In order to provide an immediate response to the financial problems which arise during emergencies, a large portion of the reserves should be invested in assets that can be liquidated in large amounts at short notice and without negatively impacting their realization value.

1. The assets in which the reserves are invested are classified into 3 levels of liquidity:
    a. Highly liquid assets that can be realized within a month without negatively impacting their realization value.
    b. Assets that can be realized within three months without negatively impacting their realization value.
    c. Low-liquidity assets that can be realized in a period exceeding three months without negatively impacting their realization value.

2. A minimum level of investment was set for highly liquid assets, and a maximum level was set for low-liquidity assets. Classification of assets into the various liquidity levels can change due to changes in market conditions.

3. At least 45 percent of the total reserves are to be invested in government bonds.

f) Active management and compliance rules:
The reserves portfolio is actively managed within the framework of limited and well defined degrees of freedom, as long as the investment policy adheres to the guidelines.

g) Risk assets:
Total combined investment in equities (Section 5.a.6) and in corporate bonds (Section 5.d.4) shall not exceed 25 percent of the total reserves.

6. The nonfinancial risks inherent in managing the reserves

In determining the investment policy for the reserves, there must be taken into account the exposure of the Bank and of the portfolio to the various nonfinancial risks inherent in investing the reserves—reputation risk, legal risk, political risk, operational risk, and so forth.

7. Measuring returns and reporting them

The reserves are managed with transparency. The Market Operations Department shall report periodically to the Monetary Committee (see 2 above) on the amount of the reserves and changes in them, the currency composition, changes in currency exposures, the asset allocation, portfolio duration, country exposure, credit risk, liquidity risk, and the return on the portfolio and its various components. The report should include an analysis of the current developments in the financial markets and their effect on the management of the reserves.

8. Handling passive breaches

The Monetary Committee will set the rules for handling passive breaches from the investment policy guidelines.

Appendix 4
Glossary

1	Active management	An investment management style in which the portfolio manager tries to achieve a return greater than that of a benchmark or market index by deciding to buy or sell securities or by various investment strategies. In this report, the term describes the contributions of decisions to invest in additional assets and countries that are not included in the basic benchmark.
2	Basic benchmark (numeraire-composition benchmark)	Represents an asset composition that is conservative and investable, which meets the first two objectives of the reserves' investment policy—maintaining the purchasing power of the reserves and managing them with a high degree of liquidity. Its currency composition is identical to the numeraire composition. It includes short-term government bonds in the numeraire currencies.
3	Basis point	0.01 percent; one ten-thousandth, or one hundredth of a percentage point.
4	Benchmark portfolio	A hypothetical portfolio constructed according to agreed-upon rules, which is used as a yardstick for evaluating the performance of an investment portfolio manager and as an anchor for the portfolio risk management.
5	CVaRp (Conditional Value at Risk)	The risk index that is used to quantify the level of risk, in terms of the expected loss on the investment portfolio in a specific time period and given a certain probability (p). In the guidelines, the Monetary Committee set the maximum level of risk for the reserves, so that given the worst 5 percent of possible outcomes, the average loss—the CVaR5%—would not be greater than 400 basis points over a one-year horizon.
6	Commercial paper (CP)	Zero-coupon securities that are sold at a discount, with an original term to maturity of less than one year.
7	Contribution of active management	The difference between the return on the reserves portfolio and the return on the basic benchmark (a benchmark whose currency composition is the numeraire composition), which measures the decisions to invest in additional assets and countries that are not included in the basic benchmark.
8	Credit risk	The exposure to the possibility of loss due to failure of timely payment on debt, whether of an issuer, a financial institution or a country, or as a result of changes in the market's evaluation of the

		probability of such an event.
9	Currency risk	The exposure to the possibility of a loss as a result of a change in exchange rates.
10	Currency terms (e.g., US dollar terms)	The rate of return obtained from multiplying the current values of all the assets by the corresponding current rates of exchange of the currency or basket of currencies.
11	Foreign Currency Committee	The Foreign Currency Committee is an internal Bank of Israel committee headed by the Governor. The Committee's role is to translate the investment policy guidelines of the reserves into detailed guidelines for managing them.
12	Foreign exchange reserves	Financial assets that are issued by foreign entities and which are denominated in a foreign currency (including gold). They are owned exclusively and managed by a central bank and are not pledged in any way.
13	Forward	An agreement to buy or sell a particular type of asset, such as foreign currency, at a predetermined price and on a predetermined future date.
14	Holding rate of return	Rate of change in the value of an asset or portfolio, including interest or dividends, over a defined period.
15	Information Ratio	The Information Ratio measures the active management of the portfolio manager relative to the risk taken, and indicates the degree of consistency in the manager's ability to generate excess returns on additional risk. The risk is calculated as the ratio of the contribution of active management to its standard deviation.
16	Interest rate risk	The exposure to the possibility of a loss as a result of an increase in the yield to maturity.
17	Investment policy guidelines	The investment policy guidelines include details on the assets, risk profile, and quantitative and qualitative limitations on the types of assets permitted for investment. It should be emphasized that the limitations on the various asset types are not a recommendation for the actual share of investment in those asset types.
18	Legal risk	The exposure to the possibility of a loss deriving from the formulation of a contract, to the detriment of the investor.
19	Liquidity	The ability to realize assets immediately without a loss in value.
20	Monetary Committee	The Monetary Committee was established in accordance with the Bank of Israel Law, 5770-2010. The Committee consists of six members—three from the Bank and three representatives from among the public. The Governor of the Bank of Israel serves as

		chairperson of the Committee. The Monetary Committee sets the policy for achieving the Bank's objectives, including monetary policy, and decides on the activities that the Bank must take to achieve them. The Committee is charged with outlining the guidelines for the reserves' investment policy, in consultation with the Minister of Finance, and with monitoring the implementation of such policy. The Committee also approves and updates the division of authorities with regard to the reserves' investment policy, between it, the Foreign Currency Committee, and the Market Operations Department.
21	Modified duration	An approximation of the sensitivity of a small change in the value of a debt instrument, expressed as a percentage of its original value, to the change in the yield to maturity (with the opposite sign) of the instrument. Measured in units of time.
22	Neutral portfolio	A portfolio whose composition is identical to that of the basic benchmark.
23	Numeraire	A currency basket used for measuring the returns on the foreign exchange reserves. See Chapter 2, Section 3 above.
24	Operational risk	The exposure to the possibility of a loss due to a system failure, human error and the like.
25	Passive management	An investment management style in which the portfolio manager tracks a benchmark or market index.
26	Portfolio duration	The average duration of a portfolio of fixed income instruments (where the duration of each asset is weighted according to its proportion of the portfolio); a widely accepted measure used to estimate the portfolio's interest rate risk.
27	Repo, Reverse Repo	Repurchase agreement; the purchase of a security simultaneously with a commitment to sell it back at a future date and at a fixed price. From an economic viewpoint, this type of transaction is identical to a loan/deposit backed by a guarantee (the security). When the Bank of Israel sells a security for future repurchase, this is a repo; the opposite transaction is called a reverse repo.
28	Risk assets	Assets featuring higher risk than government bonds. In this report, the term refers to equities and corporate bonds.
29	Risk-free portfolio	A portfolio in which the investor is not subject to gains or losses.
30	Risk premium	The excess return of a risk asset over the risk-free interest rate.

31	Spread asset	An asset which is not included in the basic benchmark. The yield spread of this asset is measured as the difference between its yield to maturity and that of a government bond with a similar term to maturity.
32	Standard deviation	A statistical measure used to quantify the dispersion of a distribution around its expected value. Often used as a measure to quantify the exposure to uncertainty. See also volatility.
33	Strategic position	An intended deviation from investment characteristics of a portfolio vis-à-vis the benchmark, managed with a long term horizon.
34	TIPS	Treasury Inflation-Protected Security; a bond issued by the US government that is indexed to the CPI in the US.
35	Treasury bill, note or bond	Debt instruments issued by the government.
36	Volatility	The standard deviation (see definition in this glossary) of the distribution of holding rates of return of a financial asset, such as a security or portfolio, over a defined time period (a day, a week, etc.).
37	Yield curve	A curve representing the yields to maturity of bonds with similar characteristics (such as the bonds of a particular country in local currency) and different maturities.
38	Yield spread	The difference between yields to maturity of two debt instruments.
39	Yield to maturity	The holding rate of return, in annual terms, which would be obtained from holding a debt instrument until its final redemption, if it was possible to invest all of its cash flows at the same rate of return until that date. Synonymous term: internal rate of return.