

Chapter 3

Monetary Policy and Inflation

- In 2016, the Consumer Price Index declined by 0.2 percent. Annual inflation has been below the target range since mid-2014. The negative inflation in 2016 was primarily the result of factors that are mainly reflective of the supply side: the decline in prices in the tradable goods sector due to increased competition, the appreciation of the shekel in terms of the nominal effective exchange rate, and low global inflation. The inflation rate was also affected by lower inflation expectations and by government-initiated price reductions.
- In 2016, the increase in domestic demand accelerated, which led to an increase the prices of domestic goods and in the GDP prices.
- The Bank of Israel used a number of tools to achieve its goals in 2016: The Monetary Committee left the interest rate unchanged at the low rate of 0.1 percent, continued its intervention in the foreign exchange market, and continued to use forward guidance—a policy launched for the first time in Israel in November 2015. The macroprudential measures adopted in recent years remained in place, and there were no new measures adopted in 2016.
- One-year ahead inflation expectations from the various sources were positive but below the lower bound of the target range for most of the year. One-year forward inflation expectations in two years were within the target range but near the lower bound. Even though inflation has been lower than the target range since mid-2014, forward expectations for longer horizons remained stable near the midpoint of the range, indicating that the inflation targeting policy remains credible.
- Home prices increased by about 6 percent in 2016, following an increase of 8 percent in 2015. Mortgage interest rates increased in parallel, and the volume of transactions declined.
- The shekel appreciated by 4.6 percent in terms of the nominal effective exchange rate in 2016, following an appreciation of 9.3 percent in 2015. After two years of stability, the trend of appreciation in terms of the real effective exchange rate resumed.
- Monetary policy in most of the advanced economies remained accommodative in 2016, and in some cases it became even more accommodative. Monetary policy in the US continued to diverge from policy in the other advanced economies, and at the end of 2016, the federal funds rate was increased for the second time, after it was increased at the end of 2015 for the first time in many years.
- In recent years, there has been a marked change in the pattern of consumer behavior in Israel. There was an increase in consumer awareness and in exposure to online purchasing of consumer goods through Israeli and foreign websites, which increased competition and created downward pressure on the prices of products.

THE OBJECTIVE OF MONETARY POLICY

The Bank of Israel's objectives, as listed in the Bank of Israel Law, 5770–2010, are: (1) to maintain price stability over time—its central goal—which is defined by the government as an annual inflation rate of between 1 and 3 percent¹, and when inflation deviates from the target range, the Bank must act to return it to within the range within a period of not more than 2 years; (2) to support other objectives of the government's economic policy—particularly growth, employment and the reduction of social gaps—provided that this support will not endanger price stability; and (3) to support the stability and proper functioning of the financial system. As of November 2011, monetary policy is determined by the Monetary Committee.²

The generally accepted framework that the central bank has several goals, with the main one being to maintain price stability, is referred to globally as a “flexible inflation targeting” regime. In such a regime, when short-term inflation deviates from the target, policy makers act to gradually return it to the target range. This enables policy makers to achieve the Bank's other goals in parallel to maintaining price stability over the medium and long terms. There are a variety of tools available to the Bank in achieving its objectives, and the Bank enjoys independence in using those tools.

1. THE INFLATION ENVIRONMENT

The Consumer Price Index declined by 0.2 percent in 2016—below the lower bound of price stability target range (Figure 3.1 and Table 3.1). Annual inflation has been lower than the target range since mid-2014. At the beginning of 2015, it reached a low of -1 percent, and has remained negative since then. Since mid-2016, there has been an upward trend in inflation.³

The fundamental factors that acted to lower inflation in 2016 included a decline in markups⁴ in the tradable goods sector; the appreciation of the shekel in terms of

Inflation continued to deviate from the target range in 2016, and even though it has done so since mid-2014, it seems that the public's confidence in the Bank of Israel's ability to return it to the target range has been maintained.

¹ This range came into effect in 2003. A target range was first set in 1992, in coordination between the government and the Bank of Israel, and declined gradually during the disinflation process that lasted for about a decade.

² Until October 2011, interest rate decisions were made by the Governor alone. Since November 2011, they are made by the Monetary Committee. The Committee consists of six members, led by the Governor, and its decisions are made by majority vote. In the case of a tie vote, the Governor has an extra vote. From November 2014, the Committee consisted of only five members, and since November 2015, it consists of only four members. Box 3.1 of the Bank of Israel Annual Report for 2011 presents a discussion of the composition of the Monetary Committee, its method of decision making and the advantages and disadvantages of decision making by committee in comparison to a single decision maker.

³ Table 3.2 shows the main components of the Consumer Price Index.

⁴ The term “markups” refers to the gap between the price a firm receives for a product and the marginal cost involved in its production. When there is full free competition, the markup is equal to zero, meaning the sale price is equal to the marginal cost of production, and the firm's profits—including the competitive yield on capital invested in the firm—is equal to zero. Under conditions of monopolistic competition, the spread is positive (positive profit), and it increases with the increase in monopolistic power.

the effective exchange rate, which also led to a decline in the shekel price of imports; the moderating global inflation environment; and the continued government-initiated price reductions. The negative inflation in 2015 also contributed to the low inflation environment (since current inflation depends on past inflation), as did expected future inflation (see sub-Section (a)).

The factors that acted to boost inflation included the increase in global oil and commodity prices, the increase in the unit labor cost, and the increase in household disposable income—a development that was the result of Israel's improved terms of trade among other things (see Chapter 2). Some of the forces that acted to lower inflation in 2016, such as government intervention and the appreciation of the shekel, were more moderate than in 2015.

Inflation deviated from the target range in 2016 mainly due to the significant decline in inflation of prices for tradable goods. The inflation rate for prices of nontradable goods came close to the lower bound of the target range, if it is adjusted for government-initiated price reductions for goods under government price controls—mainly nontradable goods (see sub-section (c)).

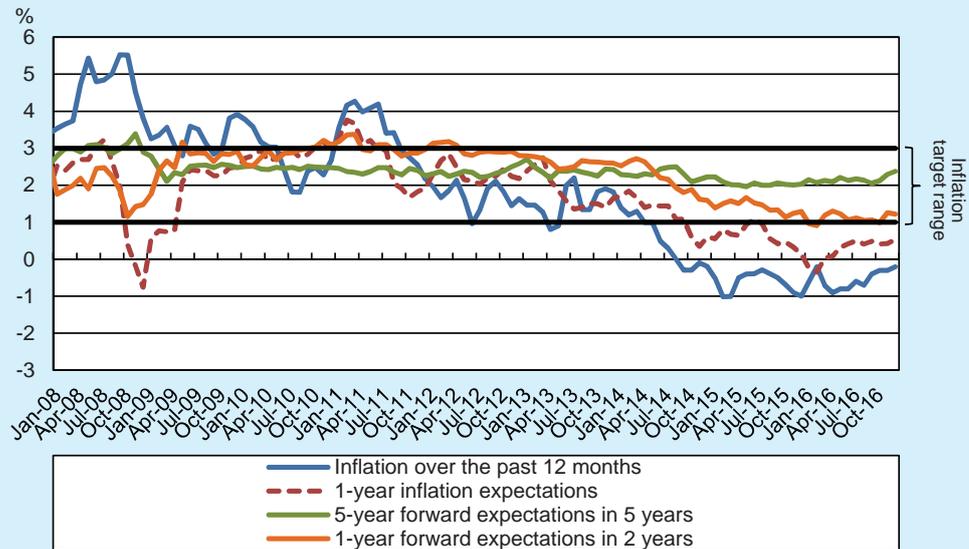
In parallel with the decline in inflation in recent years, there was also a marked decline in the volatility of the inflation rate. This decline took place in the inflation of prices of both tradable and nontradable goods.⁵

One-year inflation expectations derived from various sources (the capital market, professional forecasters and the commercial banks' internal interest rates) were positive starting in February, but ranged below the lower bound of the target range—between 0.3 and 0.6 percent. Expectations derived from the capital market and from the banks increased slightly toward the end of the year following the results of the US elections and the interest rate increase there.

Even though annual inflation has deviated from the target range since mid-2014, it seems that the public's confidence in the Bank of Israel's ability to return it to the target range has been maintained. This has been reflected, inter alia, in long-term forward expectations (sixth through tenth years), which were 2.2 percent—near the center of the target range (Figure 3.1). The public apparently understood that the decline in the inflation rate is a result of the effects of short-term supply shocks such as government intervention and the decline in global oil and commodity prices. The public's assessment is that in view of these effects and in view of the high level of economic activity and the effort to support financial stability, the Monetary Committee chose not to deepen monetary accommodation, and particularly not to lower the interest rate to negative values (see Section 3). Therefore, the public has not seen the prolonged deviation from the inflation target as a decline in the Bank of Israel's commitment to the inflation target or in its ability to act to achieve that target over time.

⁵ The index that examines the extent of volatility normalized by expectations (coefficient of variation) declined in the group of nontradable products from 1.58 in 2003–2011 to 1.09 in 2012–2016. In the group of tradable products, it declined from 3.44 to 2.65 in the same periods.

Figure 3.1
Inflation in the Past 12 Months, 1-Year Inflation Expectations from the Capital Market, 1-Year Forward Expectations in 2 years, and 5-Year Forward Expectations in 5 Years, Monthly Averages, 2008–16



SOURCE: Bank of Israel and Central Bureau of Statistics.

In 2014, when inflation in Israel began to decline and even reached negative values, there was concern that deflation would develop in the economy, a process that is accompanied by many economic risks—including a shift to recession and a weakening of the inflation target regime—particularly if the monetary interest rate is near zero and does not decline to negative values.⁶ This is because negative inflation raises the real interest rate which, for its part, acts to moderate demand and leads to a further decline in inflation, creating a vicious circle. However, in 2016, the concern of a deflationary cycle dissipated as it became clear that the low inflation in Israel in recent years was mainly the result of the fact that for a prolonged period, there were positive shocks to supply—meaning lower prices on consumer goods and production factors. The economy was also characterized by high domestic demand, and annual inflation began to increase.

The background conditions and analysis of the development of prices

a. The factors that led to price declines in 2016

The change in consumer behavior patterns in Israel

Since the social protests in 2011, consumer awareness has increased in Israel, and with it the desire to lower the cost of living. In parallel with the measures adopted

⁶ The Bank of Israel Annual Report for 2015 details the risks derived from deflation.

Table 3.1
Main indicators of inflation and monetary policy, 2012–16

	2012	2013	2014	2015	2016	2016			
						Q1	Q2	Q3	Q4
A. Inflation (percent)									
1. Inflation target	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3
2. Actual inflation ^a	1.6	1.8	-0.2	-1.0	-0.2	-1.0	1.0	0.0	-0.2
3. Seasonally adjusted quarterly inflation ^b						-1.6	0.5	0.0	0.2
4. One-year inflation expectations derived from capital market ^c	2.3	1.8	1.2	0.6	0.3	-0.2	0.3	0.5	0.5
5. Ten-year inflation expectations derived from capital market ^c	2.5	2.3	2.1	1.7	1.6	1.5	1.6	1.6	1.7
6. Forecasters' one-year inflation forecasts ^c	2.3	1.8	1.3	0.8	0.6	0.4	0.7	0.7	0.7
B. Yields (percent)^c									
1. Bank of Israel declared interest rate	2.3	1.4	0.6	0.1	0.1	0.1	0.1	0.1	0.1
2. One-year real yield to maturity on government bonds ^d	0.2	-0.3	-0.7	-0.5	-0.1	0.3	-0.1	-0.3	-0.3
3. Ten-year nominal yield to maturity on government bonds ^e	4.6	4.0	3.1	2.2	2.0	2.0	1.9	1.9	2.2
4. Ten-year real yield to maturity on government bonds ^e	2.1	1.7	1.0	0.5	0.4	0.5	0.3	0.3	0.6
C. Change in the shekel exchange rate (percent)^f									
1. Nominal effective	0.8	-7.8	4.4	-9.3	-4.6	-0.2	0.4	-2.8	-2.4
2. Vis-à-vis the dollar	0.1	-7.2	12.3	-1.4	-1.4	-0.4	-0.3	-2.4	1.7
3. Vis-à-vis the euro	-0.3	-3.1	1.1	-13.1	-4.3	1.7	0.9	-2.5	-4.3
D. Asset prices (percent)									
1. Overall yield on shares (nominal) ^f	4.5	15.3	11.5	6.8	-11.0	-8.7	-2.6	2.3	-2.3
2. Home prices	8.7	7.3	4.3	7.9	6.4	2.3	1.1	2.7	0.0
E. The monetary aggregates (nominal rates of change)^f									
1. M1 money supply	8.7	15.2	35.6	40.7	17.2	4.0	4.6	4.8	2.9
2. M1 + SRO ^g + unindexed deposits of up to one year (M2)	8.2	6.6	8.4	13.6	7.9	1.7	4.3	1.1	0.7
F. Other background data (percent, seasonally adjusted quarterly data)									
1. Unemployment rate (ages 25–64)	5.9	5.4	5.0	4.5	4.1	4.5	4.1	4.1	3.8
2. GDP growth rate ^h	2.4	4.4	3.2	2.5	4.0	3.3	5.0	3.6	6.5

^a Change in CPI during the period.

^b In annual terms. As calculated by the Bank of Israel (see article on page 20 of Inflation Report No. 30, January to March 2010).

^c Period average

^d Based on the zero curve. Period average.

^e Gross yield, based on the zero curve. Period average.

^f Average of last month in period compared with average of last month in previous period. Minus sign refers to appreciation of the shekel.

^g Self-Renewing Overnight Deposit (Current Credit Deposit).

^h Annual average compared with average of previous year.

SOURCE: Bank of Israel Research Department, Ministry of Finance and Central Bureau of Statistics.

In recent years, there has been a change in consumer behavior patterns in Israel, which is reflected in an increase in the volume of consumer products purchased by Israelis through Israeli and global websites.

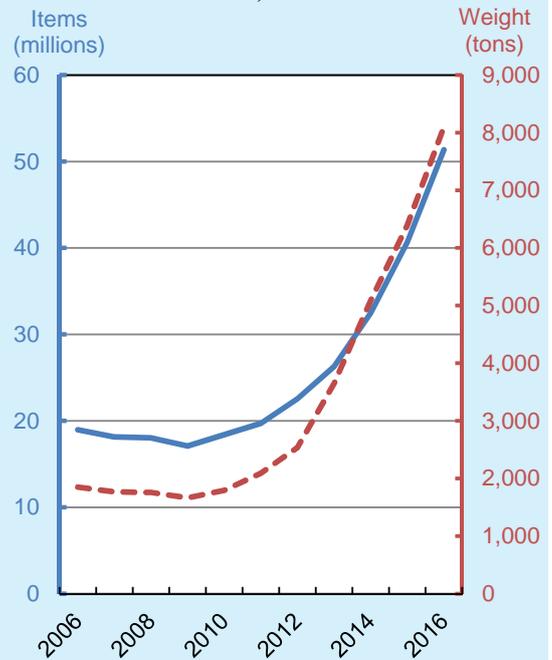
by the government in recent years to achieve this goal, there has been a change in consumer behavior patterns in Israel. This has served to increase competition in the domestic tradable goods market, to lower prices, and to reduce markups (see Chapter 1), and it contributed to the price declines in 2016. Our assessment is that the increase in competition lowered the Consumer Price Index by 0.3–0.6 percentage points.⁷

The change in Israeli consumer behavior patterns is a result of, among other things, increased consumer awareness and exposure to online purchasing through domestic and international Internet sites. The Internet makes it possible to search for products, compare prices, and make purchases within a relatively short time, generally at prices lower than in the domestic retail outlet chains. Moreover, purchases abroad are exempt from VAT if their value does not exceed \$75, and are exempt from customs duties if their value does not exceed \$500.⁸ As a result, competition with the domestic chains is increasing, which is leading to lower prices in the domestic market and a decline in the profits of domestic businesses.

An example of this is the decline in profits in the communications and computers segment and in the clothing segment in 2016 (see Chapter 1). The change in consumer behavior patterns is reflected in a number of indices:

The development of the number and weight of postal packages sent from abroad to Israel (Figure 3.2). Since these packages are sent by post, it is reasonable to assume that the significant changes taking place in their number and weight from one year to the next are the result of purchases made abroad by Israelis through the Internet. The Figure shows that in 2013, there were 26 million packages sent to Israel from abroad, and within three years—in 2016—the number doubled to 51 million.

Figure 3.2
Number and Weight of Packages Sent to Israel from Abroad, 2006–16



SOURCE: Israel Post.

⁷ This contribution is obtained after taking the rate of decline in the tradable index, which we believe is a result of the decline in markups, and multiplying it by the tradable index’s proportion of the overall index (about 36 percent). The assessment regarding the intensity of the decline in markups is based on an equation for modeling tradable prices that was developed by the Bank of Israel and estimated while using a sample from the years 2008–2016. The values range between 0.3 and 0.6 percentage points due to uncertainty regarding the contribution of the decline in markups to the tradable index.

⁸ Since 2014, the customs exemption has been expanded from \$325 to \$500.

The weight of the packages jumped from 3700 tons in 2013 to 8100 tons in 2016. The largest jump in the number of packages took place in 2016, when it increased by 11 million packages compared with 2015, while the increase in previous years averaged about 5 million packages.⁹

The number of transactions carried out abroad by credit card (Figure 3.3) The Figure shows that the number increased greatly from 2015 to 2016, taking into account the number of travel days abroad.

A Central Bureau of Statistics survey concerning

Internet purchases (Figure 3.4) asked whether respondents had used the Internet to purchase goods or services in the past year. The answers indicate a constant increase in use. The survey shows that in 2007, only 750,000 of 4.5 million respondents (16.7 percent) had made purchases over the Internet, while in 2015, 2 million out of 5.2 million respondents (38 percent) had done so.¹⁰

These indices strengthen the assessment that the decline in the prices of tradable goods in 2016 was also a result of the increase in competition and the decline in markups. These changes may moderate the prices of tradable goods in the future as well¹¹, since the trend of purchases abroad is expected to continue, and since it seems that the markups of the domestic chains are still high. In most advanced economies, there is no room for further declines in spreads in the stores, whether because the process reached its maximum potential in previous years or because the markups were very low or near zero to begin with.¹²

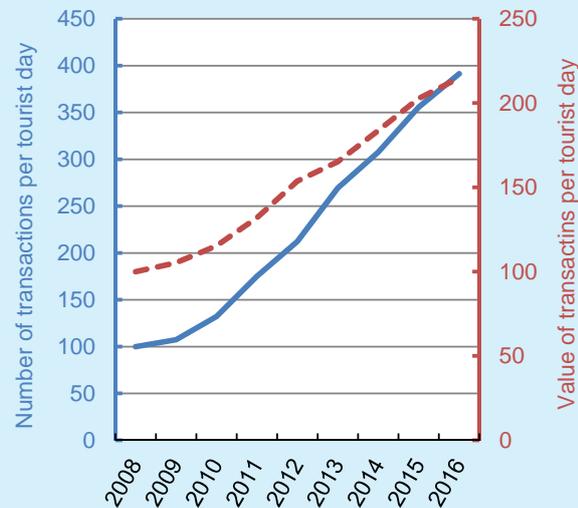
⁹ These figures do not take into account packages that are sent through private courier companies rather than through the postal service.

¹⁰ The survey for 2016 is expected to be published in mid-2017.

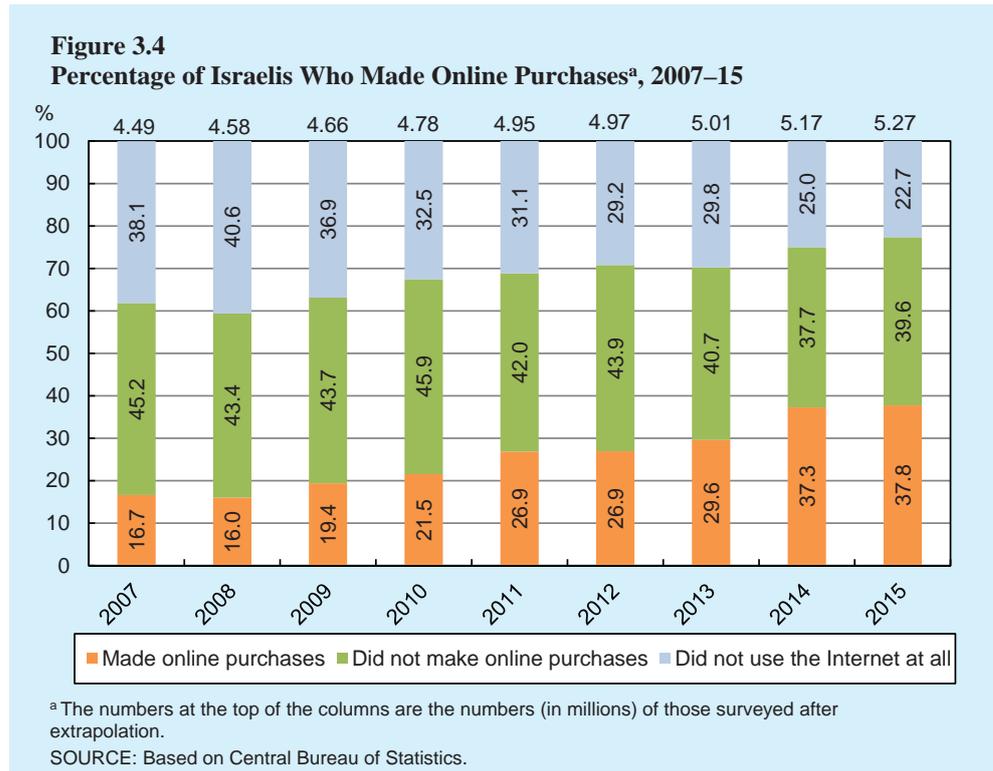
¹¹ The decline in the prices of tradable products may moderate the prices of nontradable goods since there is some substitution between the two. In contrast, a decline in the prices of tradable goods increases the disposable income of households, which may lead to an increase in the prices of nontradable goods.

¹² Studies conducted around the world show that in most examined countries, including the US, Canada, Australia and Germany, the prices of products on the Internet are generally similar and even identical to their prices in the stores. See for instance: Cavallo A. (2017), "Are Online and Offline Prices Similar? Evidence from Large Multi-Channel Retailers", *American Economic Review*, 107(1): 283–303.

Figure 3.3
Measures of the Number and Value of Credit Card Transactions Abroad by Israelis, 2008–16



SOURCE: Based on Central Bureau of Statistics.



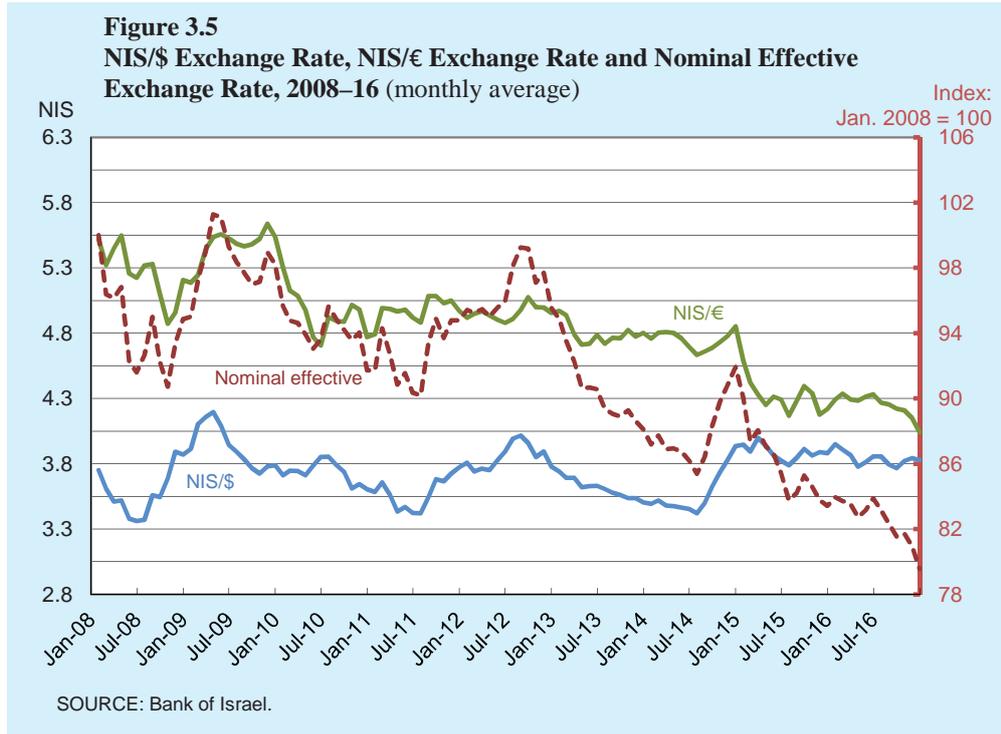
Negative inflation in 2016 was a result of the decline in prices of tradable goods, the appreciation of the shekel in terms of the effective exchange rate, and low global inflation. It was also influenced by the decline in expectations and by government-initiated price reductions.

Government-initiated price reductions

Inflation in 2016 also declined due to price reductions initiated by the government on price-controlled items. These focused mainly on nontradable goods and services such as public transportation, water and compulsory vehicle insurance. According to Bank of Israel assessments, government intervention led to a decline of 0.2 percentage points in the Consumer Price Index in 2016, compared to a decline of about one percentage point in 2015.

Appreciation of the shekel in terms of the effective exchange rate

The appreciation of the shekel in terms of the effective exchange rate contributed to the low level of inflation in 2016. The shekel appreciated by 4.6 percent following appreciation of 9.3 percent in 2015 (Figure 3.5). In recent years, there has been a marked decline in the pass-through from the exchange rate to inflation in Israel. The most significant decline took place in 2008, when rental contracts—a nontradable good constituting about 25 percent of the Consumer Price Index—were deindexed from the shekel/dollar exchange rate. In recent years, there has also been a marked decline in the transmission from the exchange rate to tradable goods. The decline in the transmission from the exchange rate to inflation is not unique to Israel, having taken place in advanced economies such as the UK and Canada, and in developing



economies in the past decade.¹³ However, increasing competition from Internet purchases may actually increase the transmission, since the price to consumers includes the shekel exchange rate.

The moderating global inflation environment

The decline in domestic inflation is also a result of the moderating global inflation environment (both actual inflation and inflation expectations were at low levels). Inflation in the past 12 months in the G4 economies (US, eurozone, Japan and the UK) was about 0.4 percent during 2016, and only toward the end of the year did it increase to 1.6 percent (Figure 3.6).¹⁴

Negative inflation in the past two years

One of the factors that moderated inflation in Israel in 2016 is the negative inflation that was prevalent in the previous two years, which acted via two main channels. The first is through its effect on the public's expectations of inflation, and through that on actual inflation during the year. This mechanism shows that there is a two-way causal

¹³ See Ozkan and Erden (2015), "Time-varying Nature and Macroeconomic Determinants of Exchange Rate Pass-Through", *International Review of Economics and Finance*; Jimenez-Rodriguez and Morales-Zumaquero (2016), "A New Look at Exchange Rate Pass-Through in the G-7 Countries", *Journal of Policy Modeling*.

¹⁴ Inflation in the G4 and the development of global energy and commodity prices can serve together as an indicator of changes in import prices in Israel (in global prices).

relationship between actual inflation and expected inflation.¹⁵ The second channel is through the mechanism of price adjustment to past inflation. The argument regarding the first channel relies on New-Keynesian theory, which holds that when firms change the price of their product, they take into account that the new price will remain in place for a certain period, and they therefore take into account not only the cost of production and the demands that they see in the present, but also those factors as they are expected to be in the future. The argument that inflation expectations influence present inflation is supported empirically in a number of countries, including Israel.¹⁶

In terms of the second channel, when firms face price rigidity and want to maintain their market share, they adjust their prices to past inflation (see Box 3.2) even if it is negative, and particularly if it has been negative for some time—the situation that has been prevalent in Israel since mid-2014. If present inflation is to a large extent dependent on past inflation (through the channel of expectations and indexation to past inflation), the process of returning to the inflation target range may be slow. In particular, a self-referential (spiral) process may develop in which low inflation moderates expectations, which—together with the mechanism of adjusting prices to low past inflation—moderate future inflation, and so forth. Empirical studies in Israel found that actual inflation is dependent on past inflation (through the inflation expectations channel and through adjusting prices to past inflation). In the eurozone, the US and other countries, it was found that since the beginning of the crisis in 2008, the extent to which inflation expectations among the public (as measured from the capital market) depend on past inflation has increased.¹⁷ It therefore seems that the negative inflation of recent years, and particularly that of 2015, contributed to the low level of inflation in 2016.

The gap between the actual interest rate and the negative estimate of the shadow interest rate in 2016

The low inflation in Israel may also be derived from the fact that monetary policy was not sufficiently accommodative from the standpoint of stabilizing inflation. This

¹⁵ In the long term, there is a high correlation, about 0.7, between annual inflation and one-year expectations derived from the capital market, forecasters and the banks.

¹⁶ Box 3.2 presents support for the argument that inflation expectations have a large effect on actual inflation. See also: Elkayam D. and A. Ilek (2009), “The Information Content of Inflationary Expectations Derived from Bond Prices in Israel”, *Advances in Econometrics: Measurement Error*, Vol. 24 ; Elkayam D. and A. Ilek (2016), “Estimating the NAIRU for Israel, 1992–2013, *Israel Economic Review*, Vol.14.1 pp. 53–74.

¹⁷ See Lyziak and Paloviita (2017), “Anchoring of Inflation Expectations in the Euro Area: Recent Evidence Based on Survey Data”, *European Journal of Political Economy*. This study found that the dependence of public expectations on past inflation is increasing in the eurozone and in other countries. The examinations regarding Israel were based on the methodology of this study, and found that the result in Israel (increasing dependency since 2008) is resilient to various specifications of the equation: In addition to just one lag of inflation—as Lyziak and Paloviita (2017) did—other lags (up to four) were included, as were other explanatory variables that may affect inflation expectations in Israel, such as oil and commodity prices, inflation in the US, and lags of monetary policy.

Table 3.2
Development of prices, by various components, 2011–16

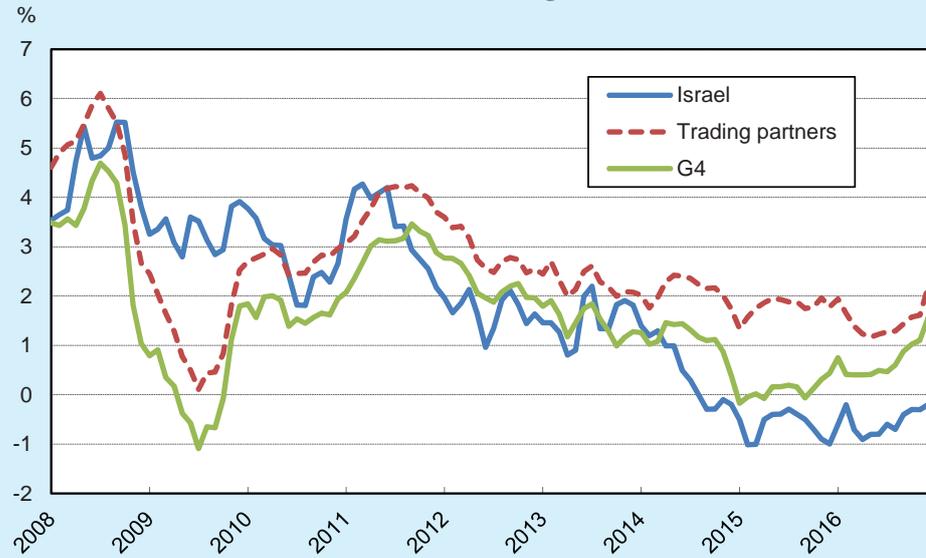
Period	Consumer Price Index		Vegetables and Fruit		Food		Housing		Dwellings Maintenance		Furniture and Household Equipment		Clothing and Footwear		Education, Culture and Entertainment		Health		Transport and Communication		Miscellaneous		Energy Index ^a		Index excluding energy, food and vegetables and fruit		Index excluding energy, food, vegetables and fruit		Index excluding government-initiated price changes		Nontradable components excluding electricity, water, communications, and vegetables and fruit		Nontradable components excluding electricity, water, communications, and vegetables and fruit		Seasonally adjusted index ^b					
	Index	Change	Index	Change	Index	Change	Index	Change	Index	Change	Index	Change	Index	Change	Index	Change	Index	Change	Index	Change	Index	Change	Index	Change	Index	Change	Index	Change	Index	Change	Index	Change	Index	Change						
2012	1.6	-1.7	4.0	-0.5	3.3	4.7	-1.4	0.4	-2.9	2.5	-0.4	5.4	6.5	0.8	0.9	0.7	2.0	2.3																						
2013	1.8	11.8	3.3	2.9	3.9	-2.5	-1.8	2.2	0.8	-2.0	4.5	1.6	1.6	1.3	1.7	3.0	2.8																							
2014	-0.2	-9.3	-2.5	3.1	0.0	-3.6	-3.7	0.4	0.8	-0.9	-0.5	-3.9	0.6	0.8	0.1	2.2	1.8																							
2015	-1.0	13.2	-0.1	2.2	-5.5	-1.6	-1.7	-0.8	-0.3	-5.4	0.1	-13.7	0.0	-0.4	0.6	1.6	1.2																							
2016	-0.2	-2.7	-1.5	1.4	0.5	-2.4	-1.0	0.7	0.8	-1.9	0.7	-0.2	0.0	0.2	0.0	1.2	1.0																							
2016																																								
January	-0.5	-0.3	-0.2	-0.5	-0.1	-0.3	-5.7	-0.3	-0.1	-0.7	0.2	-2.1	-0.4	-0.4	-0.4	-0.4	-0.4																							
February	-0.3	-1.6	0.0	0.1	0.2	0.4	-3.9	-0.2	0.1	-1.0	0.2	-0.5	-0.3	-0.3	-0.3	-0.3	-0.3																							
March	-0.2	-3.9	-0.5	0.4	-0.1	0.3	-0.4	0.4	-0.1	-0.9	-0.2	-1.6	0.0	0.1	0.1	0.1	0.1																							
April	0.4	-0.3	-0.3	0.2	0.2	-0.8	3.7	1.1	-0.2	1.5	-0.2	2.7	0.4	0.5	0.5	0.5	0.5																							
May	0.3	4.4	0.3	0.0	0.3	0.4	0.1	0.1	-0.1	0.0	0.9	0.2	0.3	0.1	0.1	0.1	0.1																							
June	0.3	-3.5	-0.5	0.1	0.0	-0.6	8.3	0.4	0.3	0.8	0.1	1.5	0.4	0.6	0.6	0.6	0.6																							
July	0.4	5.7	-0.1	1.2	0.1	-0.5	-8.2	0.3	0.6	0.7	-0.2	-0.4	0.6	0.3	0.3	0.3	0.3																							
August	-0.3	0.8	0.1	0.4	0.0	-0.5	-4.9	0.3	0.1	-1.3	0.3	-2.3	-0.2	-0.2	-0.2	-0.2	-0.2																							
September	-0.1	-1.9	0.0	0.1	-0.1	-0.5	-4.9	-0.4	0.3	-0.3	2.4	0.6	0.2	-0.3	-0.3	-0.3	-0.3																							
October	0.2	1.8	0.6	-0.3	0.1	-0.4	3.9	-0.1	-0.1	-0.1	-0.2	-0.6	0.2	0.1	0.1	0.1	0.1																							
November	-0.4	-4.3	-0.4	-0.1	-0.1	-0.1	1.5	-0.1	0.0	-0.5	0.1	1.3	-0.5	-0.3	-0.3	-0.3	-0.3																							
December	0.0	1.0	-0.5	-0.1	0.0	-0.5	6.5	-0.8	0.0	-0.1	-0.1	-0.6	0.1	0.1	0.1	0.1	0.1																							

^a The energy component includes vehicle fuels and oils, and household electricity, natural gas and diesel.

^b As calculated in the Bank of Israel Research Department (see Box 1 in the Inflation Report for the first quarter of 2010).

SOURCE: Based on Central Bureau of Statistics.

Figure 3.6
Annual Inflation in Israel and in Israel's Trading Partners and the G4^a, 2008–16



^a Annual inflation in Israel's trading partners and the G4 are equal to the weighted average according to the country weights in the nominal effective exchange rate.
 SOURCE: Based on Central Bureau of Statistics and Bloomberg.

assessment is derived from the fact that in 2016, a gap developed between the actual interest rate (0.1 percent) and the estimated shadow interest rate. The shadow interest rate reflects the interest rate derived from the interest rate rule that reacts to inflation and to real economic activity but does not directly take other objectives, such as financial stability, into account, does not distinguish between the various types of shock that influence inflation and activity, does not take into account the uncertainty and the various dilemmas dealt with by the Monetary Committee in real time, and assumes that the elasticities when the interest rate is negative are identical with those when it is positive.¹⁸ In 2016, the estimated shadow interest rate was negative, at about -0.6 percent (see Section 3c), due among other things to the low level of inflation. This is a specific estimate generated by one model, and it is therefore characterized by a high level of uncertainty.

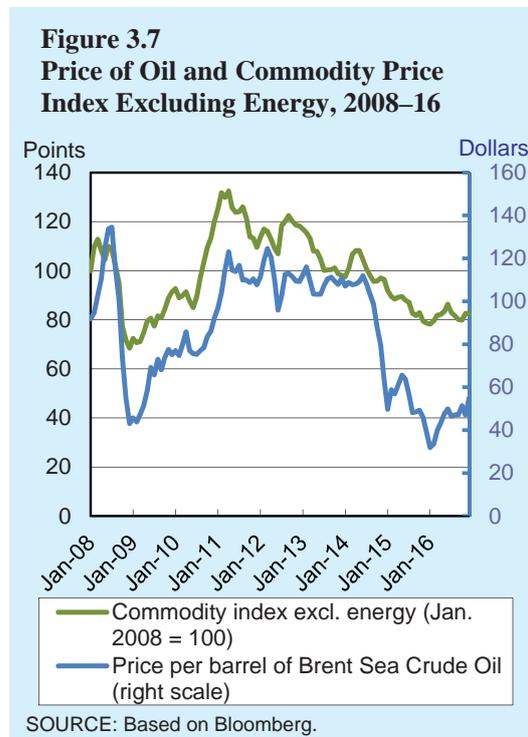
Our assessment is that the aforementioned factors contributed to a price reduction of more than 1 percent in 2016. Since the CPI declined by 0.2 percent, there were also forces pushing prices upward. Those forces are discussed below.

¹⁸ This estimate is different than those that are customary globally, particularly in the US. The shadow interest rate in the US translates unconventional policy—asset purchases by the central bank—into monetary interest rate terms.

b. The factors that led to price increases in 2016

The increase in oil prices

The price of Brent Sea crude oil increased by 41 percent in 2016, from about \$39 per barrel in December 2015 to about \$55 per barrel in December 2016 (Figure 3.7), after declining by a similar rate in 2015. At the beginning of 2016, the price of oil reached a low of about \$32 per barrel, and increased thereafter. It increased by 30 percent in the first half of the year, and by a further 10 percent in the second half. Commodity prices (excluding oil) also increased in 2016, although by a more moderate rate—about 5 percent after declining by about 18 percent in 2015. Oil and commodity prices directly affect consumer prices—through private household consumption (for instance fuel for private transportation and household maintenance)—and also have an indirect impact, through their effect on firms' cost of production.¹⁹



The increase in global oil and commodity prices and the increase in the unit labor cost and in household disposable income in Israel were contributory factors to an increase in inflation.

The increase in the unit labor cost

Another contributing factor to the increase of inflation in 2016 was a 0.8 percent increase in the unit labor cost. The change in this cost reflects the change in real wages²⁰ per work hour minus the change in labor productivity. When the gap is positive, the marginal cost to manufacturers increases and they raise prices on their products in order to maintain their profit. In 2016, the gap reached 1.1 percent (see Chapter 2). Since 2014, there has been a marked upward trend in the unit labor cost, after a decline between 2006 and 2014. Box 3.2 shows that the unit labor cost has a small direct contemporaneous impact on inflation.²¹ Since the unit labor cost increased

¹⁹ We note that inflation elasticity in relation to changes in oil prices increases as the price of oil increases. When the price of oil is \$100 per barrel, an increase of 1 percent in the price affects prices to a greater extent than the same increase when the price is \$30. Therefore, the increase in oil prices in 2016 (41 percent) affected prices to a relatively moderate extent.

²⁰ Adjusted for the GDP deflator.

²¹ This result remains in place even if the labor unit cost is replaced by the output gap.

moderately in 2016 (0.8 percent)²², it is reasonable to assume that its contribution to the increase in inflation was minor.

The increase in household disposable income

The increase in household disposable income contributed to the increase in inflation because it created private consumption demand. Disposable income increased by about 6 percent in 2016 (in CPI terms), further to an increase of about 5 percent in 2015. Real wages increased by 2.9 percent (in CPI terms), further to an increase of 2.8 percent in 2015. Private consumption increased by about 6 percent, of which current consumption increased by 4.7 percent and consumption of durables increased by 20 percent.

c. The development of prices of nontradable, domestic and tradable goods

The development of prices of nontradable goods

The prices of nontradable goods increased by 0.6 percent in 2016, and net of government-initiated price reductions, the increase was 0.9 percent. In contrast, the tradable goods price index declined by 1.7 percent.

An examination of annual inflation of the prices of nontradable goods in the past decade shows a downward trend, but the level stabilized in the past two years at a positive level, but lower than 1 percent (Figure 3.8). In previous years and in the reviewed year, the prices of nontradable goods increased mainly due to the increase in the housing index, which increased by 1.4 percent in 2016, contributing 0.6 percentage points to the increase in the prices of nontradable goods. The government-initiated price reductions in 2016 were mainly reflected in the nontradable items and contributed about 0.3 percentage points to the decline in the nontradable goods index. Net of that contribution, the rate of increase in the nontradable goods index was about 0.9 percent. This examination therefore shows that in 2016, basic forces were pushing the prices of nontradable goods moderately upward.

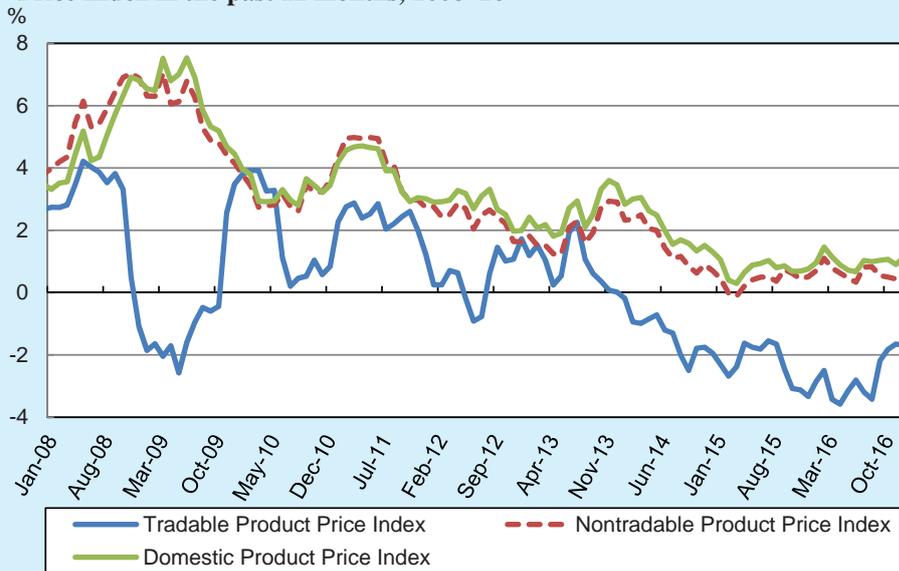
The development of prices of domestic goods

Since the prices of nontradable goods are affected by imported inputs, it is difficult to use them to clearly identify the domestic forces that affect inflation. Therefore, there is room for an index of prices of domestic goods, meaning an index of prices that are not at all affected by import prices—either the final products or the components that serve as inputs in their production.²³ This index is different from the nontradables index in two ways. First, the nontradable good cannot be exported, and second, the price of a nontradable good may be affected by imported factors of production.

²² The change (in absolute value) in the cost of labor per output unit in 2016 is similar to the average change in the past 10 years, but larger than the average over the past five years.

²³ The analysis was based on the input and output table in Orfaig, D. (2015), “Transmission Channels from the Exchange Rate to the Consumer Price Index: The Tradable Component of the CPI by Industry”, Discussion Paper 2015.04, Bank of Israel.

Figure 3.8
Development of the Tradable and Nontradable Price Indices and of the Domestic Price Index in the past 12 months, 2008–16



SOURCE: Bank of Israel.

Since the beginning of 2012, the annual inflation rate of the prices of domestic products is about half a percentage point higher on average than the rate of increase of the prices of nontradable goods (Figure 3.8). This fixed gap mainly reflects the effect of the decline in import prices and the appreciation of the shekel that took place during that time. These moderated the prices of nontradable goods by lowering the price of inputs, but had almost no effect on domestic prices.

In 2016, the domestic price index increased by 1.1 percent, while the index of nontradable goods increased by 0.6 percent, and would have increased even more had it not been for the government-initiated price decreases.

In contrast with the domestic price index, the nondomestic price index declined by about 1.8 percent, following larger declines of 2.2 percent in 2014 and 3.3 percent in 2015.

Domestic demand led to an increase in GDP prices, but there is still a positive gap between them and the Consumer Price Index. The gap is explained mainly by the improvement in Israel's terms of trade—the ratio between export prices and import prices. An increase in export prices increases GDP prices but has no direct effect on consumer prices. A decline in import prices may also be reflected in an increase in GDP prices, but it lowers consumer prices. The terms of trade improved in the past two years mainly because import prices declined, but also because export prices increased (See Chapters 1 and 2).

The development of prices of tradable goods

The prices of tradable goods have been characterized in the past decade by a higher level of volatility than the prices of nontradable goods (Figure 3.8), which mainly reflects volatility in the exchange rate and in global oil and commodity prices. Since 2012, there has been a marked downward trend in the annual rate of increase in the prices of tradable goods, and since 2014, the rate has been negative to an increasing extent. Between 2012 and 2015, the decline in the prices of tradable goods derived mainly from the appreciation of the shekel and/or from the decline in global oil and commodity prices. In 2016, the tradable index declined by 1.7 percent even though global oil and commodity prices increased. This decline was the exception to the contribution of the appreciation.²⁴ As we noted in Section 1, our assessment is that part of the decline in commodity prices is a result of the decline in markups in this sector, for instance in clothing, communications, and computers, because competition in the tradable goods market in Israel increased as a result of a change in consumer behavior.

d. International comparison of inflation rates

Inflation in Israel was negative for the third consecutive year, and in the past three years it has been lower than the weighted inflation rate in Israel's major trading partners²⁵ and in the G4 (Figure 3.6). In 2016, inflation in the G4 was 1.6 percent, it was 2.2 percent in Israel's trading partners, and it was -0.2 percent in Israel. The gap that developed between Israel and its main trading partners from 2014 to 2016 was mainly the result of government-initiated price reductions, the appreciation of the shekel in terms of the effective exchange rate, and the fact that import prices declined to a greater extent in Israel than in other countries. The gap narrowed in 2016 due to the moderation of the appreciation of the shekel in terms of the effective exchange rate and less government intervention, but the decline in markups in the tradable sector in Israel may have acted to widen it. Another factor that widened the gap was the fact that import prices in Israel (in shekel terms) continued to decline while there was a turnaround in commodity prices in the G4 (as there was in the OECD countries, see Chapter 1). The difference in the development of commodity prices was apparently a result of the differences between Israel and the G4 in the composition and source of imported goods. Despite the differences in the inflation rates, the inflation trends in

Between 2014 and 2016, an inflation gap developed between Israel and its trading partners, which was mainly the result of government-initiated price reductions, the appreciation of the shekel in terms of the effective exchange rate, and the greater decline in import prices in Israel.

²⁴ In order to analyze the contributions made by the development of the prices of tradable goods, we used an equation for modeling the prices of tradable goods that was developed at the Bank of Israel. The changes in the prices of tradable goods are explained by the nominal effective exchange rate, the global energy index, the global commodities index excluding energy, and inflation in the US. Even when import prices are included in the index (in shekel terms), a similar result is obtained.

²⁵ There are roughly 33 countries considered within the group of Israel's main trading partners. The weighted inflation rate among Israel's trading partners is equal to the weighted average of the inflation rates in each country in accordance with its proportion of Israel's trade. The effective exchange rate is also calculated based on these countries (see Galo, L. and A. Friedman (2015), "The Effective Exchange Rate in Israel", on the Bank of Israel website).

Israel and its trading partners, mainly the G4, are very similar. A significant part of the common trend can be attributed to changes in global oil and commodity prices.

2. ADDITIONAL BACKGROUND CONDITIONS AND THEIR EFFECT ON MONETARY POLICY

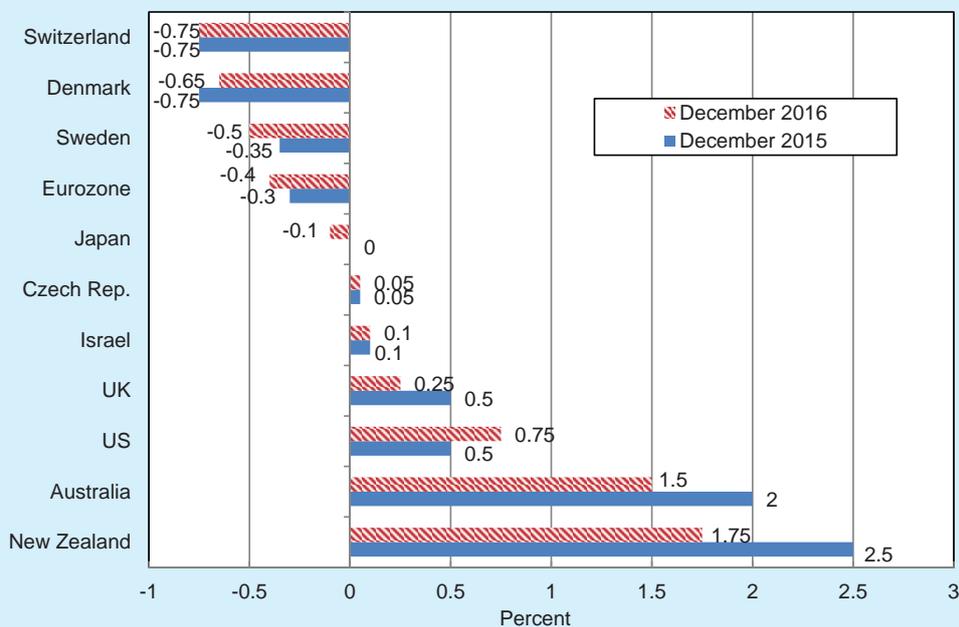
a. The economic environment and monetary policy around the world

In 2016, the global economic environment was characterized by moderate inflation and real economic activity, and by a very low interest rate. Most of the central banks in advanced economies continued to follow very accommodative monetary policies, and some even deepened monetary accommodation (by lowering the interest rate and/or engaging in quantitative easing; Figure 3.9). However, monetary policy in the US continued the trend of diverging from policy in other advanced economies, including in the eurozone. At the end of 2015, the Federal Reserve raised the federal funds rate to 0.5 percent, and at the end of 2016, it raised it again, to 0.75 percent.

Most of the advanced economies continued very accommodative monetary policies, and some even increased accommodation. Monetary policy in the US continued to diverge from policy in the rest of the advanced economies, including the eurozone.

Projections of global real economic activity were revised downward a number of times in 2016, and over time, the assessment grew more firm that growth rates in the coming years will be more moderate than previously thought at the beginning of the year. Moreover, the link between the change in global GDP growth and the change in the growth rate of world trade continued to weaken in 2016 (see Chapter 2).

Figure 3.9
Interest Rates of Selected Central Banks, December 2015 and December 2016



SOURCE: Bloomberg and central banks.

The United States

The US adopted a monetary policy that is different than the policy in most advanced economies. The federal funds rate was raised twice—at the end of 2015, following seven years of near-zero interest rates, and that the end of 2016—to 0.75 percent. According to forecasts, the rate will be increased three times during 2017. The Fed raised the interest rate due to the good state of real economic activity and the marked improvement in the labor market. The unemployment rate declined from 5.8 percent at the beginning of 2015 to 4.6 percent at the end of 2016, and professional entities' assessments were that the labor market is nearing full employment. In November, following the results of the presidential elections, uncertainty regarding the new government's fiscal policy increased. Long-term yields and inflation expectations increased relatively sharply.

Europe

In contrast with the Federal Reserve, the European Central Bank deepened its monetary accommodation in 2016. It lowered the already negative interest rate on surplus balances at the commercial banks from -0.3 percent to -0.4 percent, and increased the volume of asset purchases from €60 billion to €80 billion per month, and included corporate bonds of nonfinancial institutions. Moreover, in order to provide liquidity to the banking systems, the ECB expanded its long-term refinancing operations (LTRO) to commercial banks at zero or negative interest. The deepening of monetary accommodation is intended first and foremost to encourage activity, since growth in 2016 was low at 1.7 percent, and expected growth in the coming years is similar. In addition, it is intended to increase inflation, since the inflation rate has been near zero in recent years.

The Brexit decision in the UK referendum created a high level of uncertainty both within Europe and outside the continent. There was general agreement that the UK economy would be harmed by leaving the EU, but there was tremendous uncertainty regarding the extent or duration of the impact. In the immediate term, the Brexit decision was reflected in a significant weakening of the pound, a decline in stock prices, and widespread withdrawals from real estate funds. As such, the Bank of England lowered the interest rate from 0.5 percent to 0.25 percent in August. It is possible that the uncertainty surrounding the ramifications of the Brexit will decline once the UK signs new agreements with its trading partners.

Japan

The monetary accommodation in Japan deepened in 2016. At the beginning of the year, the Bank of Japan lowered the interest rate on surplus balances at the commercial banks from zero to -0.1 percent. In September it presented a new purchasing framework and announced a program for managing yield curves on government bonds of all durations so that the yield on 10-year bonds would maintain its current level (around zero).

The deepening of monetary accommodation was meant first and foremost to achieve annual inflation of 2 percent.

Economies similar to Israel

Economies similar to Israel, such as the Czech Republic and Sweden, enjoyed strong real economic activity, with growth of around 2.5–3.1 percent. In the Czech Republic such developments came against the background of low monetary interest rates²⁶ (0.05 percent, similar to Israel), while in Sweden the interest rate was negative (-0.5 percent). In contrast with Israel, inflation in these two economies increased to 2 percent after ranging close to zero in 2015.

The global economy affects Israel mainly through developments in the US and Europe, Israel's main trading partners. The deepening of monetary expansion in the eurozone, the stagnation in real terms there, and the Brexit all led to a significant strengthening of the shekel against the euro and against the pound. In contrast, the increase in the US interest rates, the expectations that such increases will continue, and the improved state of the real economy there, led to only a slight strengthening of the shekel (1.4 percent) against the dollar.

b. Real economic activity in Israel

Real economic activity in Israel improved in 2016 compared with previous years, as domestic demand increased. The growth rate stood at 4 percent—1.5 percentage points higher than in 2015—and is higher than the growth rate of potential GDP (see Chapter 2). GDP growth continued to be based mainly on private consumption, which increased by about 6.3 percent in 2016, after increasing by 4.3 percent in 2015. The growth rate of investments increased impressively for the first time in years—by about 10 percent. Public consumption (excluding defense imports) increased by 3.6 percent in 2016, similar to the rate in 2015. The high growth rate of imports—4 percent (net of the impact of imports by a large company)—shows that a significant portion of demand in the economy was channeled to import products, thereby creating only moderate inflationary pressure in the economy (Figure 3.8). Global demand for domestic products was moderate. Exports (excluding diamonds and start-ups) increased by 1.4 percent, similar to the growth rate of imports to the OECD.

The labor market remained strong in 2016. Employment rates reached higher levels than in the past, the job vacancy rate continued to increase, and the unemployment rate among the primary working ages (25–64) declined to an all-time low of 4 percent. These indicators showed that the labor market is close to full employment, and that there are signs of excess demand in certain sectors. An analysis by the Bank of Israel found that the decline in the unemployment rate in recent years is also a result of a

In 2016, the state of the real economy in Israel improved relative to recent years, with domestic demand increasing and leading to an increase in the prices of domestic products and in the GDP deflator. The labor market is close to full employment.

²⁶ It is worth noting that there is a “floor rate” for the nominal exchange rate in the Czech Republic.

decline in the structural unemployment rate, and it therefore contributed a little to the increase in inflation in Israel.²⁷

Nominal wages in the business sector continued to increase in 2016—by about 2.7 percent. This increase took place against the background of inflation expectations in Israel, which moderated during the recent period (see Chapter 5). This development in wages and in inflation expectations may be the result of increased competition in the tradable sector, among other things (see Section 1 of this Chapter). Increased competition lowers prices and decreases the profits of firms (in contrast with price declines that are the result of less expensive raw materials, for instance), which makes it difficult for firms to accede to wage demands from workers. In parallel, it lowers inflation expectations, since the public believes that lower prices as a result of increased competition do not necessarily lead to monetary accommodation intended to offset the effect of competition on prices. Even though nominal wages in the business sector increased moderately this year, real wages in retrospect (in terms of the Consumer Price Index) increased by about 3.2 percent due to the negative inflation.

It is important to emphasize that the picture of real economic activity received by the Monetary Committee in real time was characterized by a high level of uncertainty and sometimes, as became clear after the fact, by over-pessimism. At the beginning of the year, the various indicators pointed to a moderate decline in exports (excluding diamonds and start-ups), but the first estimate of National Accounts data for the first quarter of 2016 provided a more pessimistic picture, indicating a sharp decline of 12.9 percent in exports and low GDP growth of only 0.8 percent in annual terms. The Monetary Committee was deeply concerned about exports, and therefore changed the text of its forward guidance (see Section 3). The second estimate for the first quarter was somewhat improved, indicating a less sharp decline in exports (8 percent), and higher GDP growth (1.3 percent). The third estimate provided a very different picture, with exports declining by just 1 percent, and GDP growth of 2.2 percent. There were also significant changes due to revisions in the estimates for the following quarters, with data on exports and GDP revised upwards each time.

The uncertainty regarding National Accounts data was in addition to the uncertainty that developed in July following the Brexit vote. After the UK decided to leave the European Union, there was increased uncertainty regarding the volume of global trade and regarding the volume of exports from Israel in 2016 and in following years. As the picture became more optimistic regarding real economic activity, and particularly regarding exports, the Monetary Committee resumed its use of the original language in its forward guidance, and in September it removed reference to real economic activity. An analysis of how the forward guidance published in October 2015 and changes in the text made during 2016 affected the capital market in Israel appears below.

²⁷ Elkayam, D. and A. Ilek (2016), “Estimating the NAIU for Israel, 1992–2013”, *Israel Economic Review*, Vol.14.1 pp. 53–74.

c. The foreign exchange market

In 2016, the shekel strengthened against the G4²⁸ currencies and against those of Israel's trading partners. It appreciated by 4.2 percent against the G4 currencies, following an appreciation of 7.1 percent in 2015. Against the currencies of Israel's trading partners (the nominal effective exchange rate), the shekel appreciated by 4.6 percent, following an appreciation of 9.3 percent in 2015. The shekel's appreciation in terms of the effective exchange rate was mainly due to the weakening of the euro and the pound around the world. (The euro weakened by 4.3 percent against the shekel and by 3.4 percent against the US dollar, while the pound weakened due to the British decision to leave the European Union.)

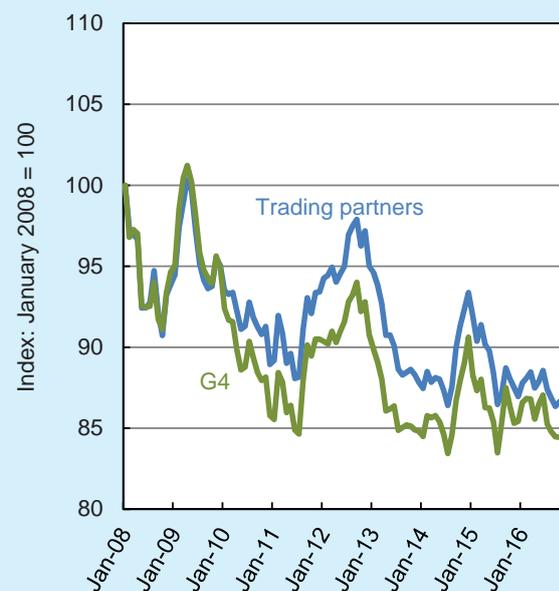
The weakness of the euro was mainly a result of the deepening monetary accommodation in the eurozone, but was also due to the state of the real economy in Europe. The shekel's appreciation against the dollar was more moderate—1.4 percent—because the Fed increased the US interest rate at the end of 2016 and there is now an expectation that interest rate increases will continue in 2017 as well.

During 2014 and 2015, the real effective exchange rate was relatively stable, but in 2016, the trend of appreciation was renewed from previous years. The shekel appreciated in real terms against the currencies of Israel's trading partners by about 1.9 percent, and against the currencies of the G4 economies by about 0.8 percent²⁹ (Figure 3.10). The resumption of the real appreciation is consistent with the narrowing of the gap in per capita GDP between Israel and the other advanced economies.

In 2016, there was a number of basic forces pushing the shekel upward: (1) the strength of the real

During 2016, the shekel strengthened against the currencies of Israel's trading partners, mainly against the euro and the pound sterling.

Figure 3.10
The Real Exchange Rate of the Shekel Against the Currencies of Trading Partners and the G4, Monthly Averages, 2008–16



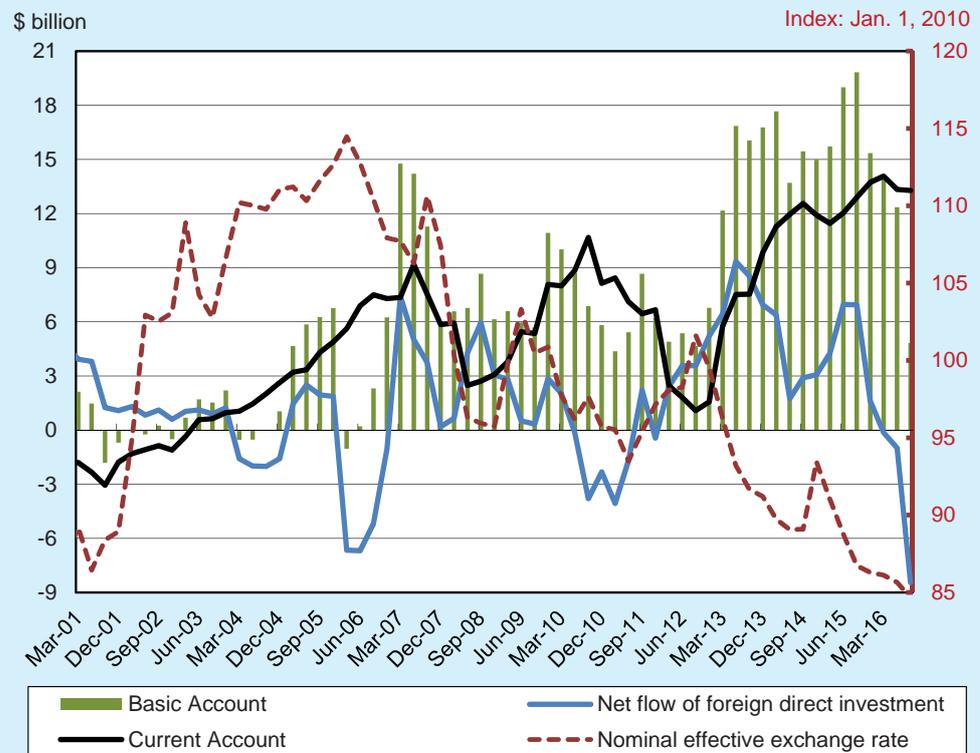
SOURCE: Bank of Israel based on Bloomberg.

²⁸ The G4 economies include the US, the eurozone, Japan and the UK.

²⁹ The 2016 average compared with the 2015 average. The appreciation during 2016 (December 2016 compared with December 2015) was about 2.4 percent against the currencies of all of Israel's trading partners, and a similar rate against the G4 currencies.

economy in Israel was reflected in the fact that per capita growth in Israel exceeded that in the G4; (2) the basic account surplus continued. The basic account includes the current account of the balance of payments and the flow of net foreign direct investment (net FDI; Figure 11). The net FDI was negative in 2016, and since the current account surplus remained stable, the upward force on the shekel remained, but was more moderate. (3) Risk in the economy may have declined relative to risk in other economies, but the shocks that took place globally, including the British decision to leave the European Union and the elections in the US led to an unexpected result. The decline in Israel’s risk was reflected in the fact that the Fitch agency raised Israel’s credit rating to A+.

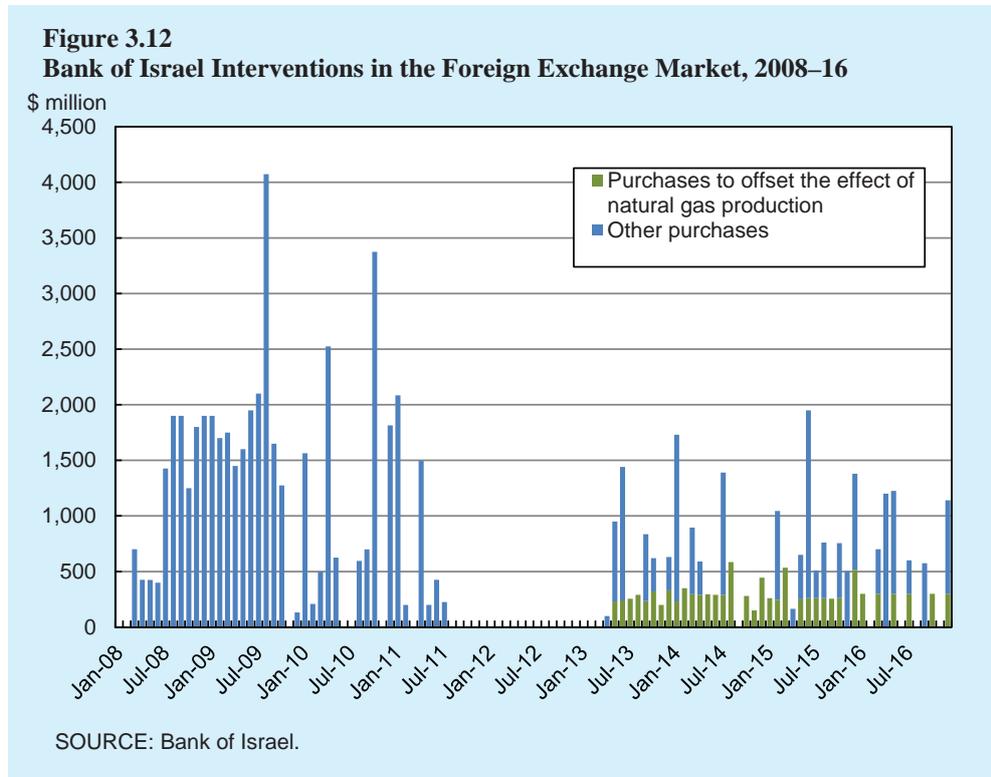
Figure 3.11
The Basic Account—the Current Account and the Net Flow of Foreign Direct Investment (four quarters moving total), and the Nominal Effective Exchange Rate (quarterly average), 2008:Q1–2016:Q4



SOURCE: Based on Central Bureau of Statistics.

The Bank of Israel intervened in the foreign exchange market, and continued its intervention policy of recent years (Figure 3.12). This intervention is among the tools the Bank uses to achieve its objectives. According to law, the Bank of Israel

is independent in terms of the volume and timing of its interventions, and it acts in accordance with needs identified by the Monetary Committee while examining the costs and benefits of intervention.



The intervention is intended mainly to support exports when the appreciation of the shekel runs contrary to basic forces that are acting to depreciate it³⁰, particularly when global demand for Israeli exports is lower than “normal” and the inflation rate is below the target range. Support for exports was particularly important in recent years, since there were forces pushing for appreciation of the shekel alongside low global demand for Israeli exports. In addition to supporting exports, the intervention lowers the excess volatility of the exchange rate, a phenomenon which increases uncertainty among exporters and investors. The interventions are supposed to reduce the negative impact on exports through the following mechanism: The intervention moderates the appreciation of the shekel in terms of the nominal effective exchange rate relative to the rate absent the intervention. Due to price rigidity, there is a depreciation in terms of the real exchange rate. Given a fixed shekel price, the relative price of Israeli products declines globally, which increases demand and therefore increases exports. In addition, weakening the real appreciation of the shekel reduces the negative impact

³⁰ Theoretical support for the stabilization of the real exchange rate is provided by De Paoli (2009), “Monetary Policy and Welfare in a Small Open Economy”, *Journal of International Economics*, Vol.77.

Foreign exchange purchases were more moderate this year than in 2015, inter alia because the shekel appreciated more moderately in terms of the nominal effective exchange rate.

to the profitability of exporters, since if the price in foreign currency is fixed, the return to the exporter increases and profitability is maintained. In Israel, a number of studies were conducted in recent years that were intended to measure the extent to which foreign exchange purchases since 2008—the year in which the Bank of Israel began intervening in the foreign exchange market—affected the nominal effective exchange rate. The studies provide initial empirical evidence of the effectiveness of the interventions, although the estimated quantitative effect is subject to a high level of uncertainty.

In order to support the objectives reviewed above, the Bank of Israel purchased about \$4.2 billion in 2016, about \$2.5 billion of which was purchased in the first half of the year (with another \$1.8 billion purchased as part of the program to offset the effect of natural gas production on the current account) (Figure 3.12). In December, due to the significant appreciation of the shekel vis-à-vis the dollar and the euro, the Bank purchased another \$800 million (with another \$300 million purchased as part of the program to offset the effect of natural gas production). The intervention in 2016 was less intensive than in 2015, when the Bank purchased \$5.7 billion (and another \$3.3 billion as part of the program to offset the effect of natural gas production). The intervention was less intensive because the shekel appreciated less in 2016 in terms of the nominal effective exchange rate.

d. Home prices and financial stability

Home prices continued to increase, even though the interest rates on mortgages began increasing significantly in mid-2015, and even though some of the housing market indicators pointed to increased supply.

Home prices in Israel increased by about 6 percent in 2016, further to an 8 percent increase in 2015. Between December 2007 and November 2016, home prices increased by 116 percent, and by 100 percent in real terms (adjusted for the Consumer Price Index). The increase continued in 2016, even though some of the indicators in the housing market pointed to increased supply, and even though mortgage interest rates began increasing significantly in mid-2015. The weighted real interest rate on mortgages increased since mid-2015 from 0.7 percent to 2 percent at the end of 2016, and since the real yield on 10-year bonds remained stable during the period, the spread between the mortgage interest rate and the interest rate on long-term bonds increased. The mortgage interest rate increased, among other reasons, due to the macroprudential measures imposed by the Banking Supervision Department in 2014, which led some of the banks to lower their share of the mortgage market and to reduce the supply of mortgages. In this context, it should be noted that the Banking Supervision Department imposed these measures because the risk to banks increased due to the high level of exposure to housing credit and to credit to the construction and real estate industry, which constitute about 45 percent of total bank credit (see Chapter 4).

The continued increase in home prices raises concern over a process in which home prices are influenced by past price increases.³¹ There is a risk to the economy in such a process, because if home prices decline sharply within a short time, it may have a

³¹ See Caspi, I. (2015), “Testing for a Housing Bubble and the National and Regional Level: The Case of Israel”, Bank of Israel Research Department, Discussion Paper 2015.5.

negative impact on financial stability and real economic activity (see the Financial Stability Report for December 2016). The concern for the macroprudential state of the economy, and particularly that of the housing market, is among the reasons the Bank of Israel has left the interest rate in positive values and not reduced it to negative levels.

3. MONETARY POLICY

In a small and open economy, there are three main transmission channels from the monetary interest rate to the economy. The first is through the interest rate's effect on investments and private consumption. A decline in the interest rate makes credit to firms and to households less expensive and reduces the interest rate on deposits, thereby increasing the incentive to invest and to consume, and reducing the incentive to save. The decline in the interest rate also incentivizes for private consumption by increasing the value of the public's assets (the "wealth effect"). The second channel is through the interest rate's effect on the exchange rate. A decline in the interest rate leads to depreciation, which in turn contributes both directly and indirectly to an increase in inflation through increased exports in the short term. The third channel is through the interest rate's effect on inflation expectations by the public and on expectations of economic activity and other variables, since the interest rate signals the extent of accommodation that the central bank intends to adopt.

In 2016, the Monetary Committee acted in an environment of negative inflation, stable growth that became stronger over the course of the year, and a continued increase in home prices. The global environment was characterized by moderate inflation and activity, while in many countries interest rates were very low and in some they were even negative (Figure 3.9). In recent years, the Monetary Committee has adopted an accommodative monetary policy. Starting in March 2015, the interest rate has been historically low, at 0.1 percent. While this may not have been enough to bring inflation back to the target range in 2016, the Monetary Committee chose this policy because it was faced with a significant trade-off between two objectives, the first being the stabilization of inflation and support of real economic activity (exports), and the second being to maintain financial stability, mainly in view of the increase in home prices that constituted a risk to the financial system.

There was significantly less need to encourage economic activity in 2016, particularly in the second half of the year, thanks to the positive surprise in National Accounts data and the positive revisions to previous figures.

The need to bring inflation back to within the target range and to assist exports supported a reduction of the interest rate to negative values. This conclusion is derived from the estimate of the shadow interest rate in Israel, and countries in similar situations—including Denmark, Switzerland, Sweden, Japan and the eurozone—actually did adopt a negative interest rate. However, the Bank of Israel chose to keep the monetary interest rate positive and to continue intervention in the foreign

The Bank of Israel Monetary Committee did not lower the monetary interest rate to negative values, out of concern for financial stability and also because it is unclear how negative interest rates affect the economy, and because the Committee's assessment was that the negative inflation did not impair the credibility of monetary policy.

exchange market, chiefly in order to support exports, but also because this measure does not directly affect the asset market.

In the reviewed year, the Bank of Israel moderated its foreign exchange purchases, inter alia because the nominal effective exchange rate was relatively stable at the beginning of the year.

In addition to interest rate policy and foreign exchange purchases, the Bank of Israel continued using forward guidance. This tool was first used by the Bank in the notice of the interest rate for November 2015. During the reviewed year, the Bank changed the text of the forward guidance a number of times due to domestic and global developments. An analysis of how the forward guidance adopted in November 2015 and changes in the text made during 2016 affected the capital market in Israel appears below.

The Bank of Israel did not use new macroprudential regulatory measures in 2016, and the Banking Supervision Department permitted “Buyer’s Price” program borrowers to take out mortgages with an LTV of 75 percent of the market price (via an assessor’s evaluation) rather than according to the actual purchase price. However, the significant macroprudential measures taken in 2013 and 2014 remained in place and had an effect on the market in 2016 as well.

As stated, the Monetary Committee kept the interest rate positive mainly in order to maintain financial stability. But there were two other considerations in addition to this motive. The first is that it is unclear how a negative interest rate would affect the economy—whether the elasticities change or they remain the same as those that currently exist in the economy under a positive interest rate. There is too little global experience in this area from which to learn. The second consideration is that the Monetary Committee chose not to react to price shocks derived from supply.

Specifically, the shocks to supply in 2016 came from two main sources: price reductions initiated by the government, and the decline in markups in the tradable sector. These shocks lowered the cost of living in Israel and expanded the disposable income of households, but also pushed inflation below the target range. If the public’s assessment is that these are shocks that lower inflation temporarily and do not have a negative impact on the credibility of the inflation target regime, then it is unnecessary for the Monetary Committee to respond immediately and forcefully. Medium and long-term inflation expectations—the measure of credibility of the inflation target regime—showed that the public did not view the lack of a response as a decline in the Bank of Israel’s commitment to the inflation target (Figure 3.1).

a. Forward guidance and its effect on yields in Israel

During routine times, when the interest rate environment is positive, the monetary interest rate can be lowered, and action can be taken to lower long-term interest rates (in accordance with the theory of expectations), thereby encouraging activity and increasing inflation. The central bank can influence the public’s expectations, inter alia through forward guidance—a declaration of intent to continue accommodative

monetary policy into the future, subject to certain conditions. The use of forward guidance is more prevalent when interest rates are close to a lower bound (zero).

As mentioned above, the Bank of Israel's Monetary Committee used forward guidance for the first time in October 2015, in the notice on the interest rate for November. The main challenge facing the Committee was in how to word the guidance so that the public would interpret it precisely according to the Committee's intentions. In October 2015, the Committee for the first time announced its assessment that the monetary interest rate will remain accommodative for a considerable time, due to developments in the inflation environment, economic growth and the global economy.³² In that notice, the Monetary Committee tried to balance clarity and credibility of the message with maintaining flexibility in the future use of monetary policy. Therefore, the Committee avoided commitments: it did not condition future monetary accommodation on the development of specific variables such as inflation or growth. In contrast, the Federal Reserve did make accommodation conditional on developments in the unemployment rate in a later version, and on the development of the inflation environment in an even later version.³³

The Monetary Committee did not change the text of the forward guidance until May 2016. In that month, in view of the sharp contraction (about 13 percent) recorded in the first estimate of exports for the first quarter of 2016, the Bank emphasized the Committee's reinforced assessment that monetary policy would remain accommodative for a considerable time. In the following month, due to the uncertainty created by the Brexit decision, the Committee again emphasized its reinforced assessment that policy would remain accommodative for a considerable time. In July and August, the guidance reverted to a text similar to that of October 2015. But in September, after the positive surprise in the National Accounts data for the second quarter and the significant upward revisions made as a result to previous figures, the Committee believed that the risks to growth had declined, and it removed mention of real activity in Israel from the text of the guidance as a factor due to which monetary expansion could be expected to continue. The Committee used this text in October and November as well. In November, due to the continued improvement in the state of the real economy in Israel and the increase in the expected interest rate path in the US—the Committee deleted the declaration that had appeared in its notices since October 2014 that it would examine the need to use various tools in order to achieve the Bank's objectives. In December, the Committee published a similar text.

As stated, the Monetary Committee used forward guidance to influence the public's expectations regarding interest rates and inflation in the short-to-medium term. A Bank of Israel analysis examined the effect of the guidance published in 2015 and of the changes made to its text during 2016. The analysis examined the changes in yields within a two-day window—from the close of trading on the day before publication of the guidance until the close of trading on the day following the guidance. Since the

In October 2015, the Bank of Israel began using forward guidance. In reaction to the first use of forward guidance, real and nominal yields for the same terms to maturity declined to similar extents, and the effect increased with the increase in the term to maturity.

³² The interest rate announcement published by the Bank of Israel on October 26, 2015.

³³ See details in Bank of Israel (2014), "*Recent Economic Developments*", number 138.

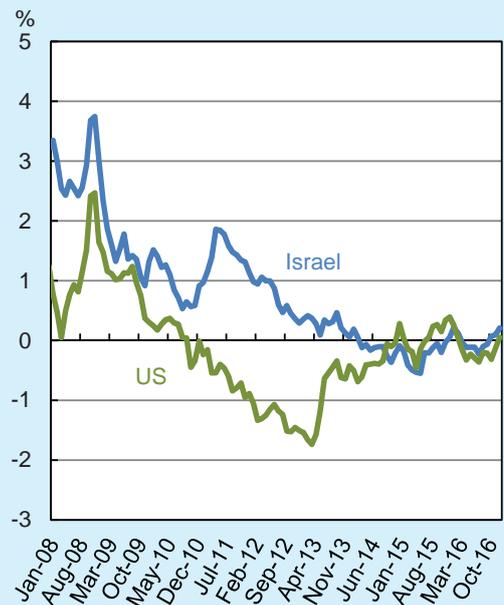
Bank of Israel publishes the guidance with the interest rate announcement, the effect of the guidance on yields must be isolated from the effect of monetary interest rate surprises and from the effects of other factors acting within the same time window, including changes in global yields. The advantage of this methodology is in the fact that it makes it possible to precisely identify the effect of the guidance, provided that all the other factors affecting yields at that time are taken into account. The disadvantage is in the fact that it does not answer the question of how persistent the effect of the forward guidance is on yields. The examination found one significant effect—the first declaration (October 2015) caused similar declines in the real and nominal yields for the same terms to maturity, and the effect grew stronger as the term to maturity increased. The estimation showed that the 3-year real yield declined by 0.03 percentage points, the 5-year yield declined by 0.11 percentage points, and the 10-year yield declined by 0.15 percentage points. The nominal yields declined by similar rates, showing that the nominal yields declined following the real yields and not due to changes in medium-to-long term inflation expectations. The changes made to the text of the guidance in 2016 did not have a significant effect on yields.

b. The development of the natural interest rate globally and its effect on Israel

It is difficult to determine whether the decline in real interest rates reflects a temporary or prolonged decline or a decline in the long-term growth rate.

Since the financial crisis of 2008 began in the US, there has been a significant downward trend in long-term real yields in Israel and abroad. For instance, in the US, the real yield to 5 years declined from 1.1 percent in 2008 to -0.2 percent in 2016 (Figure 3.13). In Israel, there was an even more significant decline. Long-term real yields mainly reflect the public’s expectations regarding the real interest rate in the economy in the medium-to-long term which, for its part, mainly reflects the expected growth rate in the economy during those terms. Economists differ on the question of the extent to which a decline in the real interest rate reflects a decline in potential growth in the medium and long terms and the extent to which the decline is a cyclical decline in actual growth. There are estimates showing a significant downward

Figure 3.13
Real Yield on 5-Year Government Bonds in Israel and the US, Monthly Average, 2008–16

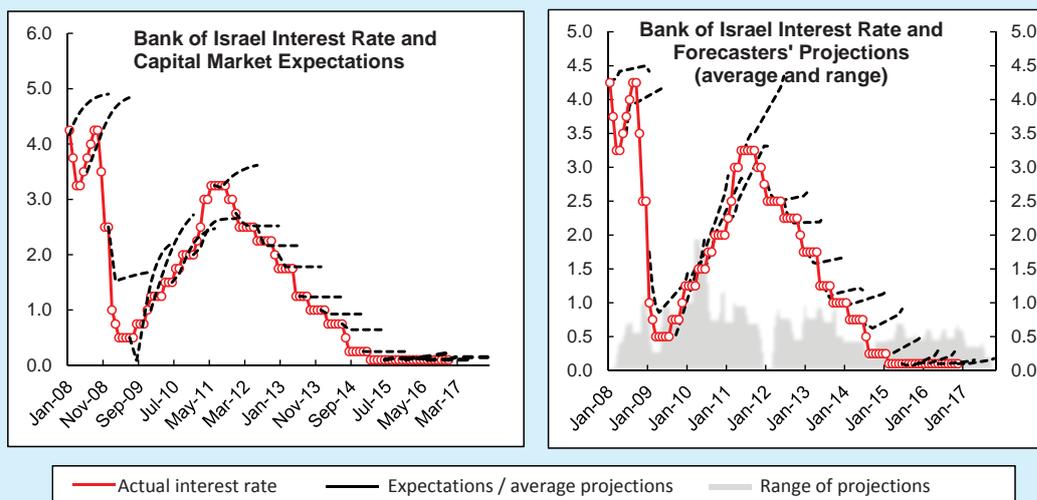


SOURCE: Bank of Israel and Bloomberg.

trend in the natural real interest rates³⁴ in major economies, including the US, Canada, the eurozone and the UK.³⁵ But these estimates are characterized by tremendous uncertainty. According to theory, this interest rate serves as an anchor for the central banks' short-term real interest rate, and is in line with price stability and with the expected potential growth rate in the one-to-two year range. A decline in the natural interest rates around the world could have an effect on the Israeli economy as well since the Israeli economy is a small and open economy and the natural interest rate in Israel is therefore dependent on the expected growth rate of potential global GDP, among other things.³⁶

The difficulty in identifying whether there was a temporary or prolonged decline in the interest rate is also reflected in forecasts of developments in the monetary interest rate. Specifically, when the Bank of Israel began lowering the monetary interest rate, the public's assessment was that this was a temporary process rather than prolonged process or the beginning of a trend. These assessments are apparent in Figure 14, which shows the path of the actual interest rate (red) and the path for one year forward (black) obtained from the professional forecasters and from the capital market (from the makam curve).³⁷ The Figure shows that after each reduction, the capital market's

Figure 3.14
The Actual Bank of Israel Interest Rate, Market Expectations, and Forecasters' Projections for the Coming Year, January 2008 to September 2017



SOURCE: Bank of Israel.

³⁴ This is an unobserved variable and it is estimated through various models using a Kalman filter. The studies that estimated the natural interest rate emphasize that the estimate is characterized by a high level of uncertainty.

³⁵ See Williams (2016), "Measuring the Natural Rate of Interest: International Trends and Determinants", Federal Reserve Bank of San Francisco.

³⁶ See Laubach and Williams (2015), "Measuring the Natural Rate of Interest Redux", Federal Reserve Bank of the United States, and Carlstrom and Stehulak (2015), "The Long-run Natural Rate of Interest, Bank of Cleveland.

³⁷ More hawkish interest rate assessments were derived from the Telbor figures.

assessment was that the new interest rate would remain at that level for the next year. The professional forecasters provided more hawkish assessments, viewing the interest rate reductions as temporary steps, and expecting that the interest rate would increase during the coming year. Only once the interest rate reached the very low level of 0.1 percent did they project that it would remain there for a considerable time, and the public's expectations regarding the interest rate stabilized, inter alia due to the forward guidance provided by the Bank.

Expectations developed along similar lines in the US and in other countries. The high assessments in Israel and abroad relied mainly on projections of global economic activity, published by the IMF and the OECD, that were too optimistic. The assessment of these international institutions was that the world would recover relatively quickly from the financial crisis, and that there were no significant forces pushing growth rates downward in the coming years, but they steadily lowered their forecasts later on. In retrospect, it can be said that the financial crisis apparently led to a long-term negative effect on global growth rates, and that even today it is hard to assess when they will return to the levels that were prevalent prior to the crisis, if at all. However, in real time, it is difficult to assess whether there has been a structural change or whether it is a longer-than-expected cyclical change.

c. Deriving the estimated shadow interest rate

Since the Bank of Israel lowered the monetary interest rate to near-zero (0.1 percent) from March 2015 and continued purchasing foreign exchange, the question arises as to whether, given the inflation environment and the real economic activity environment in Israel and globally, there should have been an interest rate reduction in 2016. As stated, the shadow interest rate reflects the interest rate derived from the interest rate rule that reacts to inflation and real economic activity in the economy but does not directly take other objectives into account and does not take into account the existing uncertainty—in the Monetary Committee's assessment—concerning the effectiveness of negative interest rates.³⁸ Therefore, the extent to which the actual interest rate deviates from the shadow interest rate can serve as an indicator of the monetary restraint or accommodation required under the inflation and activity conditions.

We calculated the estimate of the shadow interest rate as follows: In the first stage, we used a structural model developed by the Research Department³⁹ in order to estimate the unexpected shocks that hit the economy and led to developments in 2016 and previous years, including shocks to domestic and global variables. These shocks included shocks from the interest rate rule—the gap between the actual interest rate and the monetary interest rate derived from the central bank response rule used by the model.

³⁸ See note 18.

³⁹ See: Argov, E., A. Barnea, A. Binyamini, E. Borenstein, D. Elkayam, I. Rozenshtrom (2012), "A DSGE Model for Analysis of the Israeli Economy (MOISE)." Bank of Israel, Research Department, Discussion Paper No. 2012.06.

In the second stage, we conducted a simulation from the fourth quarter of 2015 for one year forward (2016), and for the forecast periods we reinserted all of the shocks derived from the model in the first stage, except for the shocks from the Bank's interest rate. The results show that in 2016, the estimate of the shadow interest rate was negative, averaging -0.6 percent, but it should be noted that it is derived from one model under certain assumptions, and is therefore characterized by a high level of uncertainty.

Similarly low interest rates are already common in a number of countries, including Sweden, Denmark and Switzerland, and the model shows that had it been imposed in Israel, annual inflation would have been close to the lower bound of the target range by the end of 2016, assuming that the estimated elasticities are also valid under negative interest rates. The positive gap between the actual interest rate and the shadow interest rate is an indication that, from the standpoint of inflation stability, the monetary accommodation adopted by the Bank of Israel was not sufficient. However, the Bank in any case maintained it, mainly due to concern for the other objectives and due to uncertainty regarding the effectiveness of negative interest and its ramifications for the economy.

4. THE MONETARY BASE, SOURCES OF CHANGE IN IT, AND MONETARY AGGREGATES

Interest is the price of money, meaning it is the alternative cost of holding liquidity. Therefore, changes in the interest rate have an impact on the demand for liquidity. When the nominal interest rate is the main tool of monetary policy, the central bank operates so that the money supply is completely flexible at the interest rate it declares, and the monetary base—meaning the total banknotes and coins in circulation as well as the commercial banks' demand deposits at the Bank of Israel—is determined by the demand for liquidity at the Bank of Israel interest rate. However, when the interest rate is near-zero and it is more difficult to analyze its effect on the economy, the developments of the monetary base and the monetary aggregates may shed light on the effect of monetary policy in such an environment. For instance, the accelerated increase of the monetary base may indicate monetary accommodation, while it is difficult to derive this from the level of the interest rate since if there are any changes made to the interest rate at all, they are minor.

a. The monetary base

The monetary base is affected by flows that are not under the Bank of Israel's control, such as government accounts⁴⁰, and by flows that are under its control, such as foreign exchange purchases and makam issuances. The Bank absorbs liquidity from

⁴⁰ Government activities also affect the monetary base, since the government's accounts are managed at the Bank of Israel (pursuant to the Bank of Israel Law).

the markets, or injects liquidity into the commercial banks, in order to provide the demand for the monetary base in accordance with the Bank of Israel interest rate. The Bank adjusts the monetary base to the interest rate that it sets by issuing makam and through interest-bearing deposits of the banks, which are issued to them in tenders and are not included in the monetary base.⁴¹ The actions taken by the Bank of Israel in relation to the monetary base are not intended to offset an injection or an absorption of liquidity from any particular source. The Bank takes into account total injections and absorptions that are not in line with the interest rate, and takes action in order that the monetary base demanded by the public is in line with the Bank of Israel interest rate.

The monetary base grew by about NIS 10.8 billion in 2016, after increasing by NIS 8.4 billion in 2015 (Table 3.4). Compared with the previous year⁴², the monetary base increased by 7.5 percent (Table 3.3). The Tables show that the foreign exchange conversions carried out by the Bank of Israel—a reflection of its interventions in the foreign exchange market—expanded the monetary base by about NIS 23 billion during the year, after having expanded the monetary base by about NIS 34 billion in 2015, because the total amount of foreign exchange purchases was smaller than in 2015. Commercial banks' deposits with the Bank of Israel increased by about NIS 28 billion in 2016, but most of the increase took place in the fourth quarter, when there was also a sharp increase of about NIS 17 billion in government injections and a NIS 10 billion increase in the makam and foreign exchange conversion items. During the first two quarters of the year, government injections were negative, and together with foreign exchange conversions they narrowed the monetary base by about NIS 8 billion in the first quarter, and expanded it by about NIS 4 billion the second quarter. At the same

Table 3.3
Rate of change in monetary aggregates, 2012–16

	1	2	1+2=3	4	5	6	3+4+5+6=7	
	Monetary base ^a	Cash held by the public	Current accounts	M1 ^b	Short-term deposits ^c up to 3 months	Short-term deposits ^c up to one year	SRO ^d	M2 ^e
(Average in December compared to average the previous December)								
2012	9.2	13.4	5.9	8.7	7.9	7.9	8.5	8.2
2013	6.5	3.9	22.3	15.2	22.2	-1.3	0.3	6.6
2014	11.6	11.7	48.3	35.6	9.8	-8.1	11.6	8.4
2015	16.3	13.9	51.4	40.7	34.2	-16.4	4.6	13.6
2016	7.5	5.8	20.7	17.2	12.2	-10.2	14.9	7.9

^a Total banknotes and coins in circulation and current deposits by the commercial banks with the Bank of Israel.

^b M1 = cash and demand deposits.

^c Self-renewing overnight deposit - a liquid daily deposit.

^d Term deposits.

^e M2 = M1+SRO+unindexed deposits of up to one year.

SOURCE: Bank of Israel.

⁴¹ Because they are not recognized for the purpose of meeting reserve requirements.

⁴² December 2016 average compared with December 2015 average.

Table 3.4
Source of change in the monetary base, 2012–16

(NIS billion)

	2012	2013	2014	2015	2016	2016			
						Q1	Q2	Q3	Q4
1. Injections from the government and the Jewish Agency	-9.1	-10.5	1.2	-14.0	3.5	-12.5	-5.4	4.5	17.0
<i>of which: the government</i>	-9.7	-10.5	1.2	-14.0	3.5	-12.5	-5.4	4.5	17.0
2. Foreign exchange conversions ^a	-0.2	19.2	24.7	34.0	23.4	3.9	9.2	4.5	5.8
<i>of which: Bank of Israel</i>	0.0	19.0	24.6	33.8	23.1	3.9	9.2	4.5	5.5
3. Total (1+2)	-9.4	8.7	25.8	19.9	27.0	-8.6	3.8	9.0	22.9
4. Bank of Israel injections	10.0	-2.4	-14.2	-11.5	-15.8	9.3	4.3	-4.7	-24.7
<i>of which: Monetary loan</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Makam</i>	8.1	-6.3	-3.2	14.1	11.1	5.0	2.0	0.0	4.0
Swap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bank term deposits	-1.0	2.0	-12.3	-26.7	-28.0	4.0	2.0	-5.0	-29.0
Interest ^b	2.3	1.2	0.6	0.2	0.1	0.0	0.0	0.0	0.0
Bond purchases	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Repo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5. Total change in the monetary base ^d	0.7	6.4	11.7	8.4	10.8	0.7	7.8	4.5	-2.2

^a This item includes, among other things, receipts (payments) in foreign exchange that the Bank of Israel and the government receive from (transfer to) the private sector, for instance income tax. These payments do not change the monetary base. They appear in the section on government injections and in this section, with the opposite sign.

^b Excluding makam.

^d The total change in the monetary base includes accounting adjustments due to transfers from abroad by the national institutions that are not presented in the table.

SOURCE: Bank of Israel.

time, there were relatively small changes in the banks' deposits. In the fourth quarter, the monetary base increased by about NIS 23 billion due to government injections and foreign exchange conversions, but that increase offset the banks' deposits which increased by about NIS 29 billion.

The monetary aggregates

The quantity of money—the M1 aggregate—includes cash held by the public and demand deposits. The quantity of money is affected mainly by the level of activity in the economy and by the interest rate: An increase in the level of activity increases demand for money, while an increase in the interest rate lowers it. In 2014–2015, the quantity of money increased significantly, by about 35–40 percent, due to the decreases in the interest rate. In 2016, the rate of the increase in the quantity of money moderated to about 17 percent since the monetary interest rate did not change. The increase in M1 was mainly a result of an increase in demand deposits, which grew by 20.7 percent, while cash held by the public increased by just 5.8 percent. In parallel with

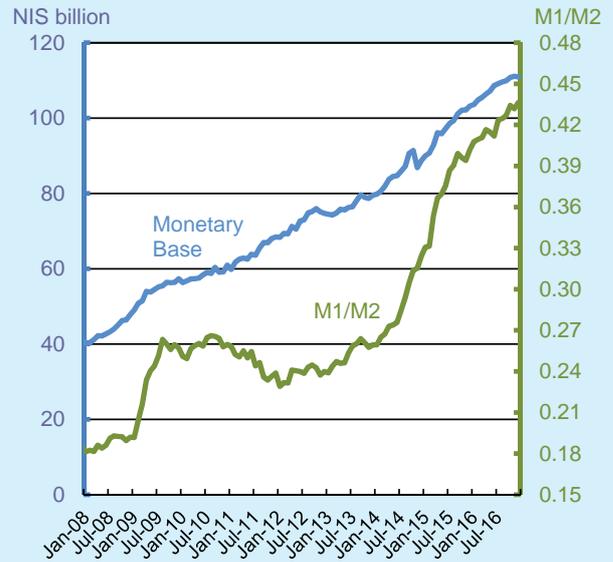
In 2016, the rate of increase in the quantity of money moderated as the interest rate remained unchanged. The increase in the quantity of money was mainly a result of an increase in demand deposits.

the interest rate decreases in recent years, there was a downward trend in cash as a share of M1, which stood at 20 percent at the end of 2016, down from 50 percent a decade ago.

An estimation of basic demand for M1 to the end of 2016 finds that the development of GDP, 1-year makam yields and other variables explains almost the complete path of M1. Evidence was found that the interest rate has a nonlinear effect on the quantity of money: When it declines to near-zero, its effect on the demand for money declines.

In parallel with the increase in M1, the upward trend in its share of M2—an aggregate that includes unindexed deposits of up to one year, in addition to M1 (Figure 3.15)—continued. The increase in this ratio began in 2012, and indicates that the public is replacing interest-bearing deposits with demand deposits because the low interest rate on unindexed deposits does not compensate for the loss of liquidity inherent in those deposits.

Figure 3.15
Monetary Aggregates, Monthly Average, 2008–16



SOURCE: Bank of Israel.

Box 3.1**How do differences between the public's assessment and that of the central bank affect the economy and monetary policy?**

This box is intended to describe the mechanism through which the two-way relationship between monetary policy and the public (firms and households) affects the economy. It is also intended to present a framework for optimal monetary policy when the public and the central bank hold different perceptions regarding the economy.

The public's assessment (expectations) have a direct and significant effect on developments in the economy. To illustrate, the public's expectations regarding future inflation affect many economic variables in the present, including the development of prices, real economic activity, and wages.¹ As such, central banks can influence the economy by influencing the public's expectations regarding these variables. For this purpose, the central bank must learn how the public formulates its expectations, through what channels it can influence and stabilize those expectations, and then choose the appropriate policy tools to do so. Specifically, central banks influence the public's expectations through conventional tools (the interest rate) and unconventional tools:

- Intervention in the foreign exchange market and in the capital market;
- Communication with the public, for instance through forward guidance², speeches made by the Governor, press releases and other publications.
- Forecasts published by the central bank.³ At some central banks, the forecasts reflect the opinion of the Monetary Committee, while in Israel they reflect the position of the Research Department, and not necessarily of the Monetary Committee. Moreover, they do not contain any commitment to policy that the Monetary Committee may adopt in the future, first and foremost because they are based on assumptions regarding the state of the economy and expected developments. However, the forecasts prepared by the Research Department do contain a significant signal regarding the Bank's view of the domestic and global economic environment, and therefore contain important information regarding expected monetary policy. The quarterly staff forecast has been published since mid-2010, and it is therefore still too early to determine whether it has a significant impact on market expectations or on the projections of professional forecasters in Israel.
- Effect on the variables that the public takes into account when it formulates its expectations. To illustrate, if the public takes past inflation into account in formulating its expectations, that inflation was influenced by, among other things, monetary policy adopted in the past.

The public's confidence in the central bank is a very important element in the Bank's ability to stabilize expectations and to achieve its objectives. In order to anchor expectations in the best possible way, a

¹ This perception is based on neo-Keynesian theory and there is much empirical evidence for it globally and in Israel.

² See Bank of Israel (2014), *Recent Economic Developments*, 138.

³ It was found, for instance, that the forecasts of the European Central Bank have a significant effect on the forecasters' projections, and the effect increased in recent years. See Lyziak and Paloviita (2017), "Anchoring of Inflation Expectations in the Euro Area: Recent Evidence Based on Survey Data", *European Journal of Political Economy*, 46, pp. 52–73.

declaration of the objectives the Bank is striving to achieve is not sufficient. It must also clarify what tools it plans on using in order to achieve those objectives.⁴

The expectations of the public (capital market and the professional forecasters) regarding various variables, including inflation and the interest rate, generally differ from the expectations of the central banks, as is the case in both Israel and many other countries.⁵ The differences may be a result of different assumptions regarding the future path of the variables, but they can also be a result of different perceptions regarding the structure of the economy, which may be reflected in different specifications of the model describing the development of the economy and/or different parameters (elasticities) in the models. If the central bank ignores these different perceptions, it may have a negative impact on its ability to achieve its objectives and on the well-being of society. For instance, Evans and Honkapohja (2003)⁶ showed that when monetary policy relies on the mistaken assumption that the public's expectations are in line with the central bank's model (model-consistent expectations), it may cause inflation and other variables to deviate from their targets for a prolonged period and even cause economic divergence. Orphanides and Williams (2008)⁷ showed that when monetary policy operates according to an interest rate rule derived from that assumption, it could have a significant negative impact on well-being. Honkapohja and Mitra (2005)⁸ showed that when the central bank acts according to its internal assessments alone, and ignores public expectations, the economy may suffer from a high level of instability.

In order to deal with the differences in expectations, the central bank could, among other things, take the public's assessment into account when it makes policy decisions—for instance by using an interest rate rule that reacts directly to the public's expectations. Such a policy allows the bank to properly anchor the public's expectations and to stabilize the economy, even if the public's expectations are not in line with the Bank's model and may be formulated in various ways, since they directly affect the development of the economy through the public basing its decisions on them. In order to deal with the differences in expectations in the most efficient way, the central bank can build a model for a mechanism through which the public formulates its expectations, and exploit that information to set the interest rate that will achieve its objectives in the most efficient manner (optimal policy).⁹

The public's assessments are an important component in a variety of indicators used by the Bank of Israel to formulate monetary policy. Specifically, the public's assessments regarding expected inflation are used as a main variable in various models developed by the Bank of Israel¹⁰, and they influence the

⁴ See Eusepi S. and B. Preston (2010), "Central Bank Communication and Expectations Stabilization", *American Economic Journal: Macroeconomics*, 2:3, pp. 235–271.

⁵ Expectations derived from the capital market reflect the average market expectations. In contrast, the forecast of each forecaster, and of the central bank, reflect the mode of the forecasts, meaning the forecast with the highest likelihood.

⁶ Evans G. and S. Honkapohja (2003), "Expectations and the Stability Problem for Optimal Monetary Policies", *Review of Economic Studies*, Vol.70.

⁷ Orphanides A. and J. C. Williams (2008), "Learning, Expectations Formation and the Pitfalls of Optimal Control Monetary Policy", *Journal of Monetary Economics*, Vol. 55.

⁸ Honkapohja S. and K. Mitra (2005), "Performance of Monetary Policy with Internal Central Bank Forecasting", *Journal of Economic Dynamics and Control*, Vol. 29/

⁹ See Ilek A. and G. Segal, (2014), "Optimal Monetary Policy Under Heterogeneous Beliefs of the Central Bank and the Public", Bank of Israel, Discussion Paper 2014.01.

¹⁰ See for instance Ilek A. (2006), "A Monthly Model for Evaluation of Inflation and Monetary Policy in Israel", Bank of Israel, Discussion Paper 2006.04 (in Hebrew).

forecasts of the path of inflation and of the monetary interest rate. The public's assessments are also considered in the formulation of the staff forecast published by the Research Department every quarter since 2010. The judgment in the forecast is based on a number of indicators, which are in turn based on internal analyses by the Research Department, assessments prepared by international institutions, assessments formulated by the capital market and professional forecasters regarding inflation, the interest rate and other variables, and on the Companies Survey and the Consumer Confidence Index—indicators of the state of real economic activity in Israel.

The meetings between the Bank and the professional forecasters are an example of the dialogue between the Bank and the public. At the end of each quarter, the Governor and members of the Monetary Committee meet with a forum of professional forecasters, present them with the Research Department's staff forecast, and learn from them how they understand the developments in the economy and what they think are the risks to the forecast.

Box 3.2

The factors affecting the development of inflation in Israel in the short-term

A recent speech by Janet Yellen, Chair of the US Federal Reserve, dealt among other things with a list of the factors behind developments in the inflation rate in the US:

“[...] Theory and evidence suggest that [...]the underlying] trend [of inflation] is strongly influenced by inflation expectations that, in turn, depend on monetary policy [...] The anchoring of inflation expectations [...] does not, however, prevent actual inflation from fluctuating from year to year in response to the temporary influence of movements in energy prices and other disturbances. In addition, inflation will tend to run above or below its underlying trend to the extent that resource utilization—which may serve as an indicator of firms' marginal costs—is persistently high or low.”¹

In those few sentences, Yellen summarized the current theoretical framework for describing the development of the inflation rate. According to this approach, actual inflation is motivated by three main factors: inflation expectations, supply shocks, and utilization of the means of production (the output gap is a common approximation of it²). The link between the three factors and the inflation rate is referred to in the literature as the “Phillips Curve”³, and focuses on the tradeoff between inflation and real economic activity: Assuming that the other variables remain constant, an increase (decline) in utilization—due to an increase (decline) in demand—will lead to an increase (decline) in the inflation rate.

¹ Yellen J. L. (2016), “Macroeconomic Research After the Crisis” (<https://www.federalreserve.gov/newsevents/speech/yellen20161014a.htm>)

² The output gap is equal to the gap between actual GDP and potential GDP (GDP consistent with full price elasticity), and is an approximation of the aggregate marginal cost borne by firms, and particularly of aggregate demand.

³ Named for A. W. Phillips, the economist who, in 1958, first found empirical evidence of the tradeoff between the inflation rate and the level of real economic activity. A survey of the history of the Phillips Curve appears in Gordon (2011).

The following is an estimation of the Phillips Curve in Israel, in which we examine whether it plausibly describes the development of inflation in the economy, what can be learned from it about the development of inflation in Israel, and whether it remained stable in recent years.⁴

The Phillips Curve in Israel

Since Israel is a small and open economy, we estimate an augmented Phillips Curve that is suited to economies of this type:

$$(1) \quad \pi_t = \gamma E_t \pi_{t+1} + (1 - \gamma) \pi_{t-1} + \lambda (y_t - y_t^p) + \alpha \pi_t^{IM} + v_t$$

π_t where denotes the actual inflation rate, $E_t \pi_{t+1}$ denotes the expectations formulated during the previous period regarding the inflation rate in the coming period, π_{t-1} denotes the inflation rate with a lag, y_t denotes the actual GDP, y_t^p denotes the potential GDP, π_t^{IM} denotes the rate of change in the relative price of imports (relative to the GDP deflator), and v_t denotes the error term—an unobserved component that includes supply shocks or measurement errors. It should be noted that according to this equation, actual inflation is a function of, among other things, the weighted average of inflation expectations and inflation with a lag. The parameter γ shows the weight of inflation expectations in determining actual inflation: as it increases, the weight increases and the effect of past inflation declines. The equation also includes the output gap and the relative price of imports, a variable that reflects the fact that the Israeli economy is small and open and external factors may therefore influence the inflation rate in it.

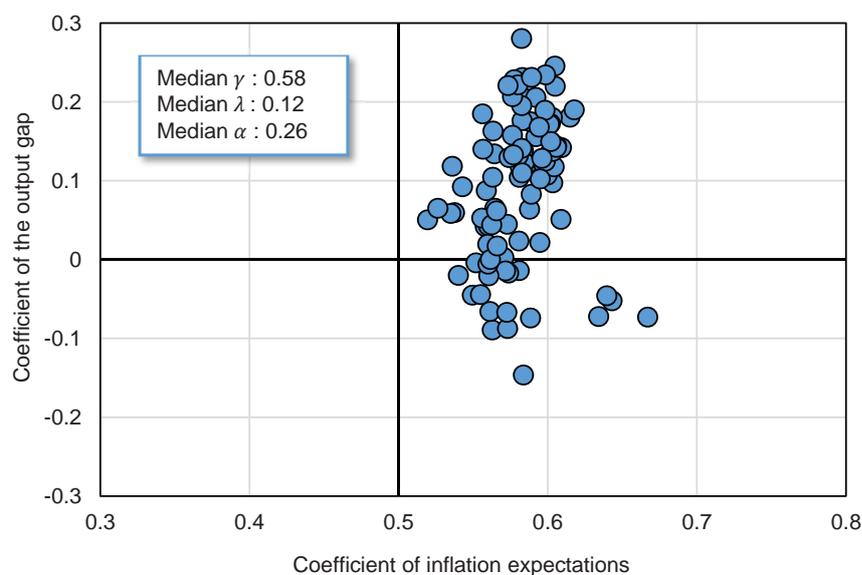
We estimated this equation with the help of the quarterly inflation rate of the Consumer Price Index (in annual terms, seasonally adjusted), minus the midpoint of the inflation target range (2 percent). The group of explanatory variables includes actual inflation in the coming quarter (in annual terms) as an approximation of inflation expectations⁵; inflation with a lag of one quarter; the output gap (GDP figures taken from the National Accounts, seasonally adjusted); the quarterly change (in annual terms) in the relative price of imports (Import Price Index divided by the Product Price Index); and the group of exogenous variables (rates of change of the price of oil, commodity prices and the euro-dollar exchange rate). In addition, we use a group of instrumental variables that includes the exogenous variables and lags of the inflation rate, the output gap, and the changes in the relative price of imports. In order to deal with the high level of uncertainty regarding the precise formulation of the estimation equation, we estimate about 100 different formulations of it, which differ in the estimations of the output gap (which were derived through a variety of statistical and structural methods used for detrending), and the set of exogenous and instrumental variables. We estimate the equation using data from the period from 2003:Q1 to 2016:Q2, because during that period, the current inflation target regime (1–3 percent) was stabilized and maintained.

⁴ This box joins other studies that estimated the Phillips Curve in Israel, including Ribon (2004), Binyamini (2007), Lavi and Sussman (2007), Argov and Elkayam (2010), and Elkayam and Ilek (2016).

⁵ The equation was also estimated with the use of expected inflation from the survey of professional forecasters (conducted by the Bank of Israel) and inflation expectations derived from the capital market (the results are not shown). Most of the findings are robust to changes in the estimate of expectations, other than the finding regarding the stability of the relative weight given to expectations. In that case there was an increase toward the end of the sample.

Figure 1 shows the results of the estimation, where each dot symbolizes a pair of coefficient estimators generated by one of the formulations—(a) the estimate of the coefficient of inflation expectations (the horizontal scale) and (b) the estimate of the coefficient of the output gap (the vertical scale).⁶ The median value of γ is 0.58, about 80 percent of the estimates of it are in the range between 0.56 and 0.61, and about 14 percent of the estimates are significantly larger than 0.5 (at a 10 percent significance level). Accordingly, inflation with a lag also has a significant effect on actual inflation, since its coefficient completes to 1, and its median value is therefore 0.42. The direction and magnitude of the output gap's effect on the inflation rate (the estimates of λ) are characterized by a high level of uncertainty, which is apparently derived from measurement errors in the output gap. The median value of λ (hereinafter “the slope of the Phillips Curve with respect to the output gap”) is 0.12, and 80 percent of the estimated coefficients are in the range between -0.05 and 0.22. Most of the estimated coefficients (79 percent) are positive, in accordance with the theory, but only 10 percent of them are significantly positive (at a 10

Figure 1
Estimates of the Coefficients of the Output Gap and Inflation
Expectations Derived from the Various Specifications of the Equation^a



^a The Figure presents the estimates obtained from Equation (1) based on data from the period between 2003:Q1 and 2016:Q2. The distribution of the estimates reflects the uncertainty in the specification of the model and not the uncertainty in the estimation. The estimates of the coefficient of the relative import price (α) are not presented in this figure.

⁶ The distribution of the points in the Figure reflects the uncertainty in the formulation of the estimation equation, and not the uncertainty of the estimated coefficients themselves.

percent significance level).^{7,8} Finally, the coefficient of the rate of change of the relative price of imports is positive and significant in all estimations (not shown in the Figure). Its median value is 0.26, and 80 percent of the estimates of it are between 0.16 and 0.39.

Stability of the parameters

We now examine the stability of the parameters estimated throughout the sample in order to test whether there were structural changes in the Israeli economy during the period that affected the three parameters of the Phillips curve. For this purpose, we estimate Equation (1), in its various versions, in a moving 5-year window. The results are presented in Figure 2. The blue (solid) line represents the median value of each parameter, and the area between the dashed lines represents the range between the 10th percentile and the 90th percentile of the obtained coefficients. The coefficient of inflation expectations (similar to the coefficient of lagged inflation) is relatively stable throughout the sample. The slope of the curve with respect to the output gap is stable around near-zero values in most of the estimated period, although there is some “flattening”—meaning a decline in —after 2008. Moreover, there is a change toward the end of the period, with the estimates being more volatile and the median obtained coefficient lower and even negative. Finally, there is a significant downward trend in the coefficient of the relative price of imports throughout the sample. That estimated coefficient is 0.4 in the first estimation window, and 0.1 in the last window, and toward the end of the period it is even slightly negative.

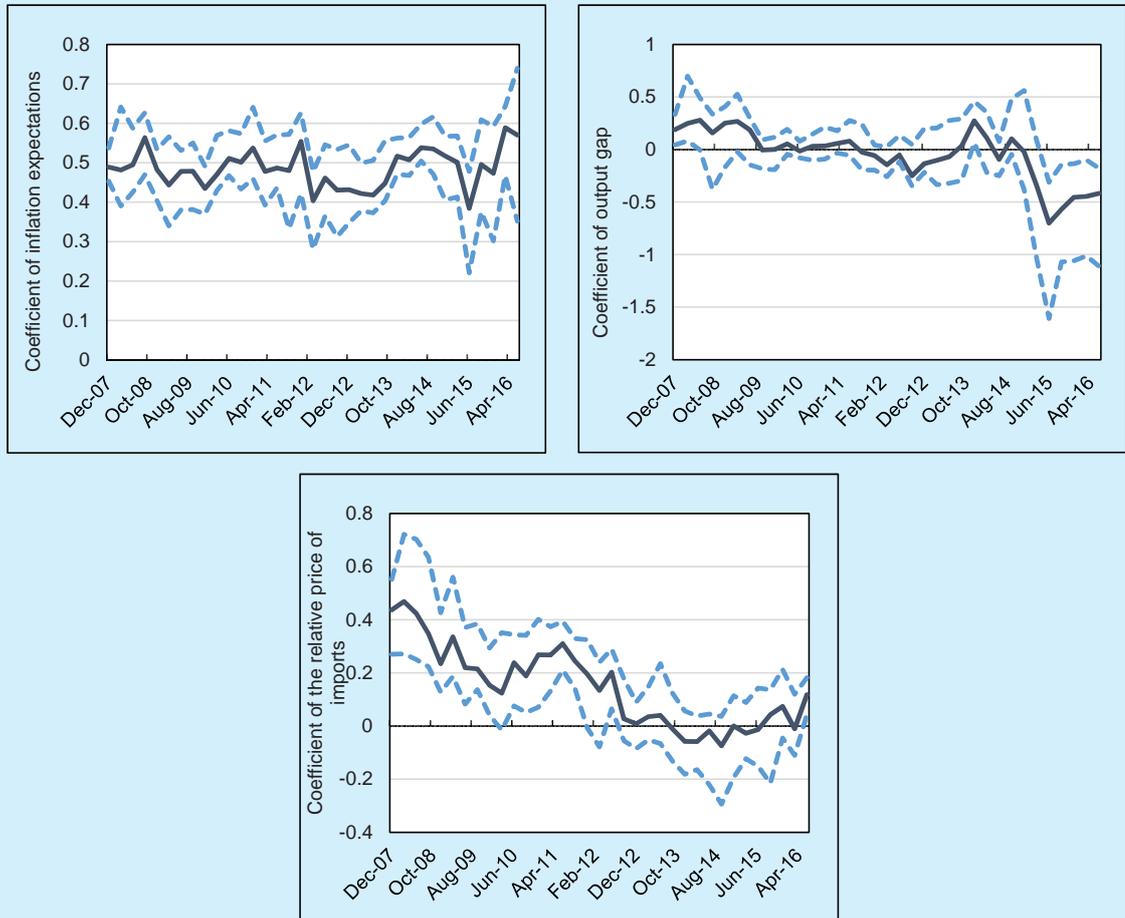
Discussion and conclusions

The results presented above show that both inflation expectations and past inflation are important in determining the present level of inflation. Moreover, this conclusion is robust to changes in the selected estimate of the output gap and to the group of exogenous and instrumental variables, and is stable throughout the sample. The findings are not as unequivocal concerning the elasticity of inflation relative to the other two factors that motivate it—the output gap and the relative price of imports. While we find that the coefficient of the output gap is generally positive, it is for the most part not statistically significant, and it is unstable—which reflects the measurement problem of the output gap variable, among other things. In contrast, external factors reflected in the coefficient of the relative price of imports have a positive effect, but that effect became less intensive during the sample period. Our assessment is that this weakening apparently reflects the decline in the level of the transmission between the exchange rate and inflation that took place in the past decade in Israel (see discussion in Chapters 1 and 3), which, for its part, reflects the fact that landlords stopped indexing rent to the exchange rate of the US dollar,

⁷ Ten percent of the estimations generated the result that both α and β are positive and significant, in other words, wherever α is positive and significant, β is also positive and significant.

⁸ Segal (2017) provides a possible explanation of the fact that the coefficient of the output gap occasionally obtains negative values in estimations of the New Keynesian Phillips Curve. He shows that a model wherein the technological shocks fill a dominant role in the development of GDP, spurs a negative correlation between the output gap generated by the model and the output gap calculated through an HP filter.

Figure 2
Phillips Curve Coefficients: Estimate in a 5-year Moving Window^a



^a The Figures presents the estimates of the median values of the coefficients (solid lines) and the range between the 10th percentile and the 90th percentile of those estimates (dashed lines). The area between the dotted lines reflects the distribution of the various estimates obtained and not the uncertainty in the estimated parameters. The estimates were obtained from a 5-year moving window estimation based on data from the period between 2003:Q1 and 2016:Q2.

among other things.⁹ Between the two, the external factors and the output gap, the former is apparently more dominant in spurring inflation, but as stated, its coefficient declined in recent years, and there is tremendous uncertainty regarding its current level of dominance.

Our findings regarding the slope of the curve are at least partially consistent with a pair of similar studies that estimated the Phillips Curve on an international panel. For example, Blanchard et al. (2015)

⁹ To wit, when estimating the same equations and replacing Consumer Price Index inflation with the Index net of the housing component (not shown), obtains a lower coefficient (0.17 compared with 0.26), and in the estimation of the moving window, we do not find the downward trend that is observed in the estimation with the overall index.

found that the slope of the curve relative to the level of utilization of production factors remained stable in the past two decades, and that it stabilized at a low level (beginning in the mid-1990s).¹⁰ However, in most countries, there was no evidence found that the slope of the curve changed following the crisis (between 2007 and 2014), while such evidence is found, as stated, in Israel. The findings concerning the stability of the coefficient of inflation expectations—as well as the stability of the coefficient of lagged inflation—are also consistent with Blanchard et al. (2015).¹¹ In contrast, those researchers obtain the opposite findings regarding the coefficient of the relative price of imports, finding that it increases over time. The finding that foreign factors play a dominant role in spurring the inflation rate is consistent with the work of Mihailov et al. (2011), who estimated the Phillips Curve with a panel of 10 small and open economies.

The findings presented above have a number of implications for monetary policy. First, since inflation expectations are very important in determining the inflation rate, it is important to relate to them and to the ability of monetary policy to influence them (see Box 3.1). Second, the inflation rate is characterized by persistence (which is reflected in the size of the coefficient of the lagged inflation rate). This means that shocks to inflation—including monetary policy shocks—have a persistent effect. The finding concerning the slope of the curve relative to the output gap (the slope is low, mostly not significant, and in recent years has declined) contains an advantage and a disadvantage for monetary policy makers. The advantage has to do with the fact that sharp changes in domestic activity, such as a recession, currently have less of an effect on the inflation rate than in the past. The disadvantage is that sharp changes in the inflation rate, for instance as a result of supply shocks, require a more aggressive policy in order to return inflation to its target range within the predefined timeframe, since policy affects inflation through its effect on activity. However, this conclusion must be qualified: The empirical findings regarding the slope of the curve relative to the output gap are apparently influenced by measurement problems in the data used in the estimation, particularly the output gap estimates. Moreover, it is important to remember that the results are based on an estimation of the reduced form model, and it is therefore impossible to explain why there is a change in the slope: It is unclear whether it is a result of structural changes, such as changes made by firms in the frequency of price or wage adjustments, or whether it is a result of structural changes in factors outside the economy (Razin and Binyamini, 2007). Accordingly, each of the possible structural explanations may have different consequences for the conduct of monetary policy. Finally, the finding regarding the increasing influence of outside factors, and the difficulty in measuring the output gap compared to the relative ease of measuring the outside factors, may help policy makers formulate their assessments concerning the inflation environment.

¹⁰ In the estimation by Blanchard et al. (2015), the cyclical unemployment rate served as an indicator of the utilization of the factors of production.

¹¹ In the estimation by Blanchard et al. (2015), they use long-term (10-year) expectations of the professional forecasters and annual inflation with a lag of one quarter.

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Table 3.A.1
Interest rate decisions since 2014

For month:	Interest rate decision (percentage points)	Interest rate (percent)	Distribution of Monetary Committee members' votes in interest rate decisions		
			Increase	Keep unchanged	Reduce
January-14 ^a	No change	1	0	5	0
February-14 ^a	No change	1	0	5	0
March-14 ^a	-0.25	0.75	0	1	4
April-14	No change	0.75	0	6	0
May-14	No change	0.75	1	5	0
June-14	No change	0.75	0	6	0
July-14	No change	0.75	0	5	1
August-14	-0.25	0.5	0	0	6
September-14	-0.25	0.25	0	1	5
October-14	No change	0.25	0	6	0
November-14 ^a	No change	0.25	0	5	0
December-14 ^a	No change	0.25	0	5	0
January-15 ^a	No change	0.25	0	5	0
February-15 ^a	No change	0.25	0	5	0
March-15 ^a	-0.15	0.1	0	1	4
April-15 ^a	No change	0.1	0	5	0
May-15 ^a	No change	0.1	0	5	0
June-15 ^a	No change	0.1	0	5	0
July-15 ^a	No change	0.1	0	5	0
August-15 ^a	No change	0.1	0	5	0
September-15 ^a	No change	0.1	0	5	0
October-15 ^a	No change	0.1	0	5	0
November-15 ^b	No change	0.1	0	4	0
December-15 ^b	No change	0.1	0	4	0
January-16 ^b	No change	0.1	0	4	0
February-16 ^b	No change	0.1	0	4	0
March-16 ^b	No change	0.1	0	4	0
April-16 ^b	No change	0.1	0	4	0
May-16 ^b	No change	0.1	0	4	0
June-16 ^b	No change	0.1	0	4	0
July-16 ^b	No change	0.1	0	4	0
August-16 ^b	No change	0.1	0	4	0
September-16 ^b	No change	0.1	0	4	0
October-16 ^b	No change	0.1	0	4	0
November-16 ^b	No change	0.1	0	4	0
December-16 ^b	No change	0.1	0	4	0

^a For these discussions, there were five members of the Monetary Committee.

^b For these discussions, there were four members of the Monetary Committee.

SOURCE: Bank of Israel.

Table 3.A.2**Import prices, the exchange rate and consumer prices, 2012–16**

Period	Import prices in dollars					Import prices in shekels ^a				
	Consumer prices	Investment goods	Manufacturing inputs		Dollar Exchange rate	Consumer prices	Investment goods	Manufacturing inputs		Consumer Price Index
			Excluding fuel	Fuel				Excluding fuel	Fuel	
(compared to previous period, yearly averages)										
2012	-2.7	-2.9	-3.6	-5.3	7.8	4.8	4.7	3.9	2.0	1.7
2013	1.1	1.5	0.2	-2.6	-6.2	-5.2	-4.9	-6.0	-8.6	1.5
2014	0.6	1.0	-1.3	-8.0	-2.9	-2.3	-1.9	-4.2	-10.6	0.5
2015	-5.5	-6.6	-9.7	-42.1	-1.2	-6.6	-7.7	-10.7	-42.7	-0.6
2016	-0.3	0.6	-4.1	-16.5	3.2	2.9	3.8	-1.0	-13.5	-0.5
(compared to the same period last year, fourth quarter)										
2012	-1.2	-1.3	-2.3	-5.8	3.2	1.9	1.9	0.8	-2.7	1.6
2013	2.3	3.2	-0.8	-1.2	-7.7	-5.6	-4.8	-8.4	-8.8	1.9
2014	-2.1	-2.3	-3.5	-24.8	-1.4	-3.5	-3.6	-4.8	-25.8	-0.2
2015	-4.2	-4.6	-9.6	-41.0	-1.4	-5.6	-6.0	-10.9	-41.8	-0.9
2016	-0.3	-1.0	-1.9	14.4	8.2	7.9	7.1	6.2	23.9	-0.3
(compared to the previous quarter)										
2016										
Q1	-1.0	0.0	-1.6	-18.3	0.3	-0.7	0.3	-1.3	-18.0	-1.0
Q2	1.1	1.0	0.2	17.9	1.7	2.8	2.7	1.9	19.8	0.5
Q3	0.0	-0.7	0.6	11.0	3.0	3.0	2.2	3.6	14.3	0.5
Q4	-0.4	-1.3	-1.0	7.0	3.0	2.6	1.6	2.0	10.2	-0.2

^a Import prices in dollars are multiplied by the shekel-dollar exchange rate.

SOURCE: Bank of Israel and Central Bureau of Statistics.