

# Inflation measurement and inflation expectations: the case of Israel

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## Abstract

Inflation in Israel has been below the inflation target for over two years now and inflation expectations at short horizons have followed actual inflation to below the target. The low inflation outturns are the result of sharp, negative external and domestic price level shocks, including the global declines in oil and other commodity prices along with some domestic policy mandated price declines. A number of other countries are also experiencing below-target inflation. This paper discusses issues and challenges for monetary policy in Israel that have arisen as a result of the prolonged effects of the negative price shocks against the background of an already highly expansionary monetary policy and relatively solid real economic developments.

Keywords: Inflation measurement, inflation expectations, price stability

JEL classification: E42, E31, E58

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The Bank of Israel's mandate is threefold: (i) to maintain price stability – its central goal – which is defined as annual headline inflation between 1 and 3%; (ii) to support other objectives of the government's economic policy, particularly growth, employment and the reduction of social gaps; and (iii) to support the stability and proper functioning of the financial system.

The Bank of Israel Law (2010) and the Monetary Policy Committee (MPC) have translated these multiple goals into a "flexible inflation target", whereby short-term deviations from the inflation target are accommodated so long as the MPC can foresee a return of the annual inflation rate to within the target range within 24 months (as stipulated in the Bank of Israel Law), thus allowing the Bank to pursue its other goals in parallel to maintaining price stability over the intermediate and longer term.

Note that inflation is defined, by law, in terms of the CPI and not on the basis of a perhaps more stable "core inflation" measure. This poses special challenges at times of unusually large (and persistent) external shocks. The past two years presented such a challenge, and indeed despite expansionary monetary policy, inflation was not only below target but, in fact, negative during both 2014 and 2015. Clearly, disentangling pressure on prices from transitory shocks that affect the headline figure is crucial in order to devise the appropriate policy response, particularly since monetary policy must be forward-looking and should not respond to past inflation shocks unless they provide solid indication of future deviations of inflation from target. Extricating the right signal from an array of prices requires two things: first, understanding how the various components affect headline inflation and the extent to which it is affected by external<sup>2</sup> shocks; and second, understanding how inflation expectations are formed, and particularly how, when and to what extent those expectations are affected by seemingly temporary, external shocks.

## 1. Measuring inflation

The focus of monetary policy is on the percentage change in headline CPI over the previous 12 months, in part due to substantial monthly fluctuations even when the overall inflation level is low. For instance, April is known for an unusually high increase of CPI in part due to annual holidays (Passover and Easter) associated with high spending and sometimes due to weather-induced price hikes in fruits and vegetables. In Israel, imports of fruits and vegetables are strictly limited, which causes high monthly inflation volatility despite it being a relatively minor item in the CPI basket (2.7% of the CPI basket), and despite the low inflation level (the rolling 12-month inflation rate has averaged 1.8% since 2000). While fruits and vegetables can easily be isolated from the CPI, the seasonality of other prices is difficult to assess as the calendar month in which so-called "seasonal" affects occur may vary, eg the

<sup>2</sup> Even the word "external" requires interpretation – in some cases, shocks are clearly external, such as an episode of unusually bad weather which affects the prices of locally grown fruits and vegetables. But sometimes shocks are policy-induced, such as a reduction of local taxes or a statutory reduction of state controlled prices on goods like water and electricity – a policy which itself may very well reflect a reduction in inflation expectations – in which case such shocks are not entirely "external" to the inflation environment.

seasonality of weather patterns is not regular and Jewish holiday periods<sup>3</sup> are not fixed according to the Gregorian calendar. Examining inflation over the past 12 months nets out this seasonality.

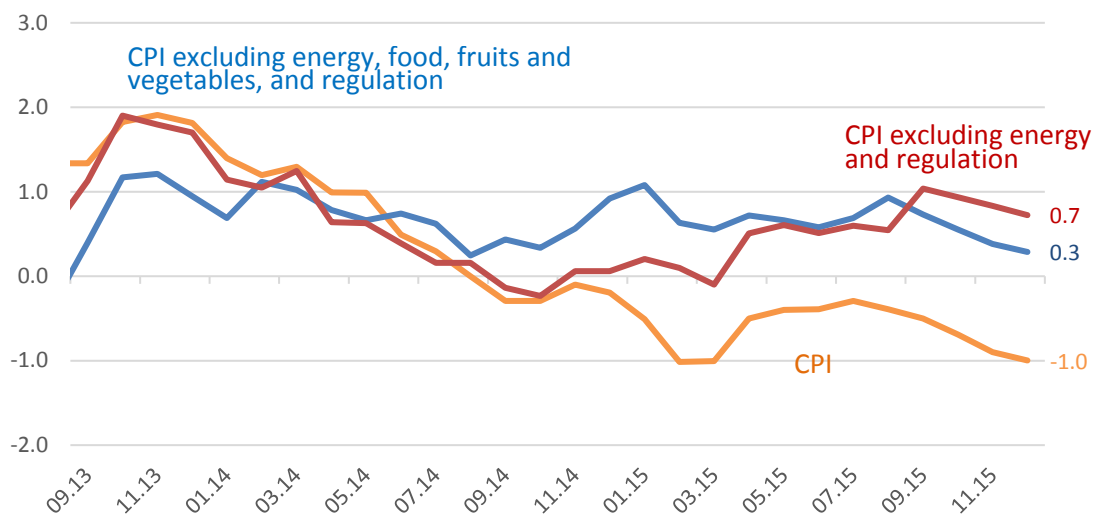
Although we do not define a specific core inflation measure, we attempt to isolate elements that are considered to be external and temporary shocks to domestically generated price movements, understanding that it is not always clear how external or how temporary these elements are. Lately, the dramatically falling oil prices and consequent impact on energy prices in Israel (which are determined by an administrative process, partly in response to world prices) have had a significant impact on headline inflation, so we attempt to isolate this component, attributing it to external factors.<sup>4</sup> Other external shocks such as VAT rate changes (eg the 2015 reduction) or adjustments of administrative fees (television fees, water prices etc) have also been segregated. Thus when looking at Graph 1, we can see that these shocks all pushed annual inflation downward in 2015, with headline annual CPI at -1%, while CPI excluding food, fruits and vegetables and “administrative measures” stood at 0.3% – still below the 1–3% inflation target.

## Headline vs underlying inflation

Twelve-month inflation, 2013–15

Factors of a one-off nature and energy prices contribute to low inflation

Graph 1



In general, in a further attempt to disentangle external from domestically generated price movements, we also consider two CPI indices: one of tradable goods and services (36% of CPI) and one of non-tradable goods and services (64% of CPI). As can be seen in Graph 2, these have also exhibited considerably different inflation rates over the past few years. The interpretation of these price movements must of

<sup>3</sup> Typical items subject to “holiday” pricing are holiday packages, flights and hotels etc.

<sup>4</sup> See below the discussion of inflation expectations which quotes from Sussman and Zohar (2016) on the impact of oil prices on inflation expectations.

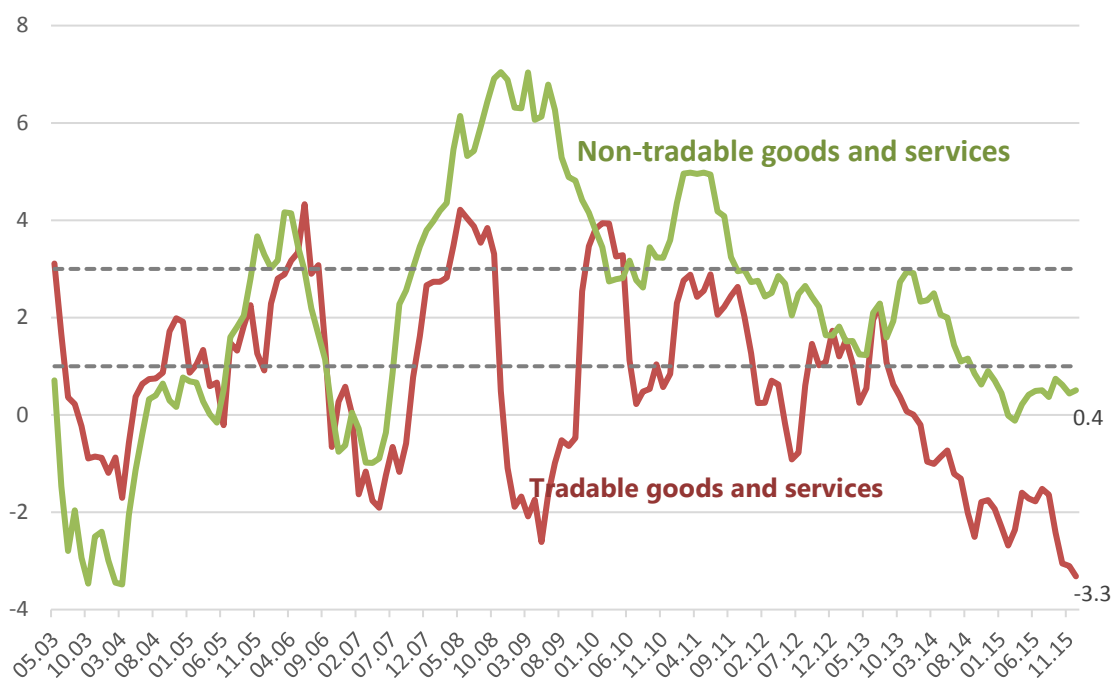
course take into account effective exchange rate movements, although this impact appears to be quite moderate. As we will see later, the most recent estimates of exchange rate pass-through are now quite low in Israel, amounting to about 10% overall (ie a 10% devaluation of the currency would lead to a 1% CPI increase) and to half that amount when excluding the housing component of CPI (rental prices).<sup>5</sup>

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## Non-tradable and tradable goods and services

12-month inflation, 2003–15

Graph 2



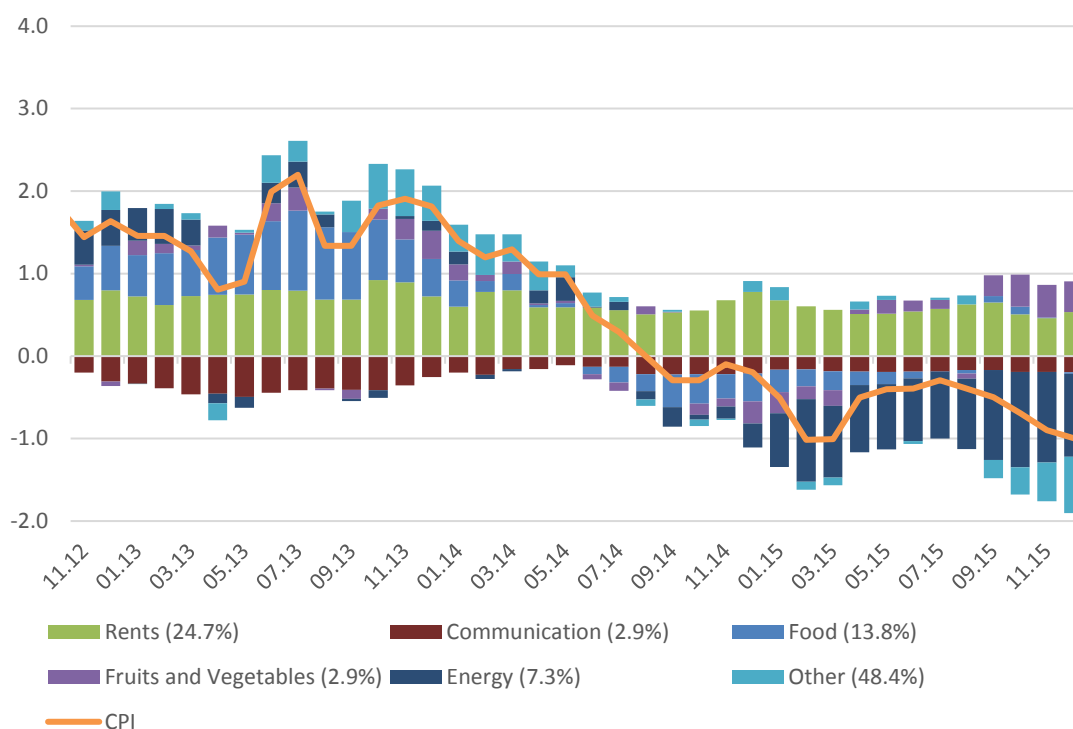
Structural changes can impact relative prices and the overall price level, and though these are often difficult to identify and quantify, some sectors have undergone major reforms specifically in order to enhance competition; the ensuing effects on prices have stood out in the past few years. One example is the telecommunications sector, which underwent a major reform in 2011 and which has since seen continual price reductions, as can be seen in Graph 3.

<sup>5</sup> See Ribon (2015b).

## Selected sector contribution to CPI

12-month % change, 2012–15

Graph 3



Administrative or regulated prices amount to approximately 15% of the CPI, although one should be careful in inferring that price movements in this category are due entirely to exogenous factors – clearly some of the adjustments are made in response to the general inflationary environment. So they may be considered “one-off” for the specific month or quarter in which they occur, but one should be more careful about excluding them from the general inflation undercurrent. As can be seen in Graph 4, regulated or administratively set prices tend to move in tandem with the rest of the CPI basket, although, as noted, lately it has tended to pull the inflation rate down further.

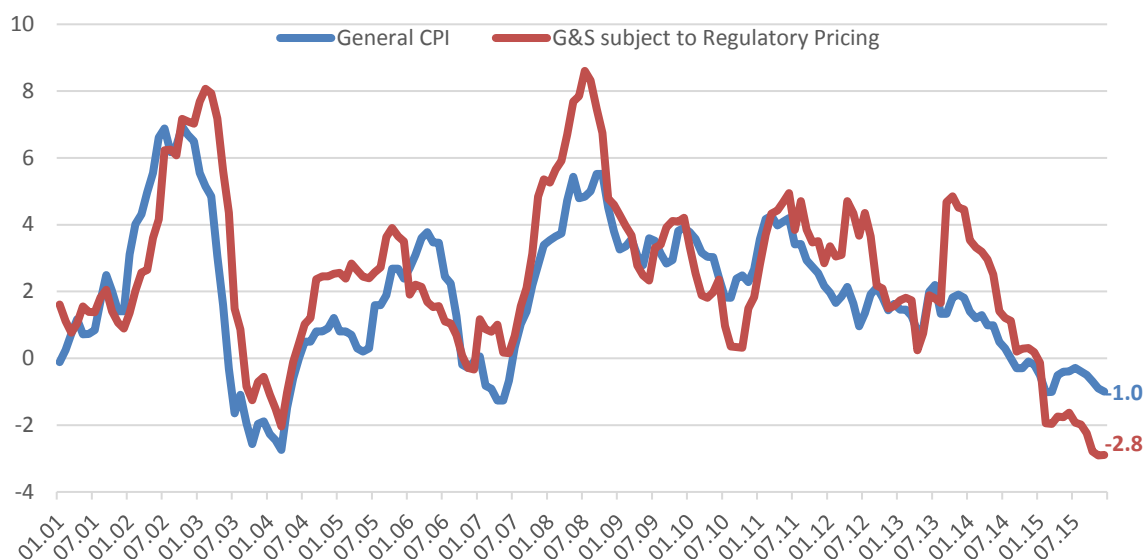
A few years back, a more thorough investigation in search of a better core inflation measure was undertaken by Ribon<sup>6</sup> in which 20 different indices were scrutinised, and none were found to clearly dominate headline CPI, though each contributed to our understanding of current inflationary trends.

<sup>6</sup> See Ribon (2009).

## Changes in administrative prices vs headline CPI

12-month annual % change, 2001–15

Graph 4



We have not assessed how the distribution of income may have affected the general inflation rate, though a recent paper by Ribon has attempted to evaluate some aspects of the reverse relationship: to what extent have different socioeconomic groups experienced different inflation rates given the wide variance in the composition of the consumption basket? By carefully looking at the residential area of various income groups, at a time when housing costs have increased rapidly nationwide but at different paces in different regions of Israel, Ribon found that "... there is wide variance in the rate of price changes of consumption baskets among different households, but there is no strong persistence over time in the relative inflation for a large part of the population groups".<sup>7</sup>

The housing component of the Israeli CPI is not only a significant part of the basket (24.7%), but it has also been the only consistent positive contributor to inflation in recent years, as can be seen in Graph 3. Its measurement in the CPI, even for owner-occupied housing, is based on rental prices (both continuing contracts and new rental contracts), though the rental market is not as developed in Israel as in most other advanced economies. This is the case not only because the share of owner-occupied housing is relatively high (68%) but mainly due to the fact that there exist few long-term rental properties (that is, apartment buildings or other residential properties built for the specific purpose of long term rental). Note, however, that the rental price increases over the past eight years pale in comparison to those of (directly measured) owner-occupied housing prices, as can be seen in Graph 5<sup>8</sup>.

<sup>7</sup> See Ribon (2015a).

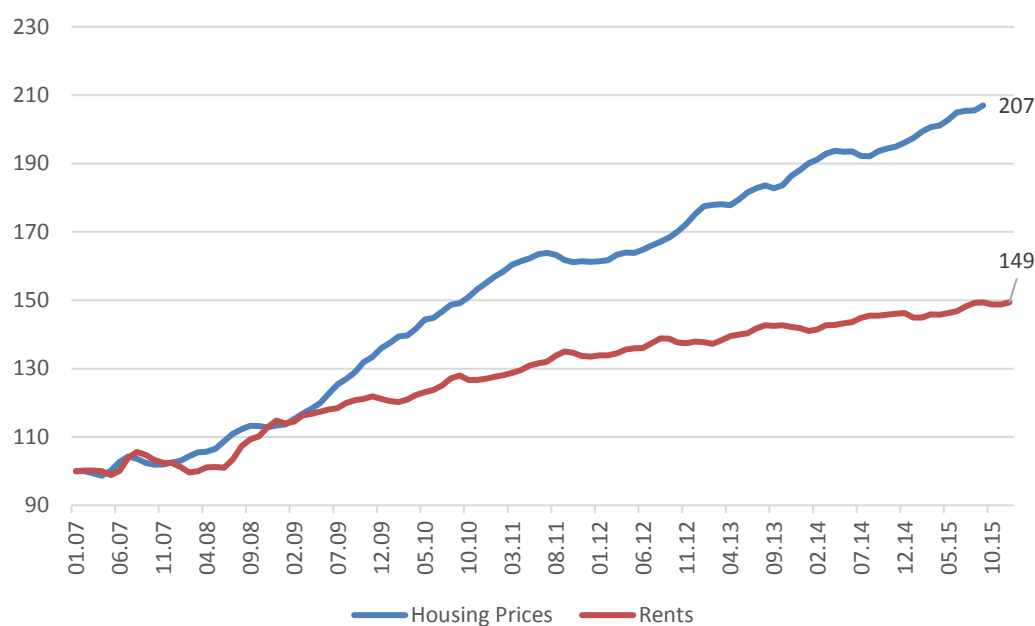
<sup>8</sup> We will not address here the thorny issue of financial stability that arises in the wake of sharp and sustained increases in housing prices, but note that the Supervisor of Banks has repeatedly introduced macroprudential measures, such as limiting LTV and payment-to-income ratios and the

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## Housing prices and rents

2007 = 100

Graph 5



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## 2. The inflation process: attaining price stability (and beyond?)

From hyperinflation in the late 1970s and early 1980s to low double-digit inflation in the 1990s, the Israeli economy has now enjoyed the longest period of price and financial stability in its history. In spite of an environment characterised by severe international crises and significant domestic stress, Israel finally attained price stability near the beginning of the current millennium and has maintained low single-digit inflation for 15 years.

The notion of price stability includes stability of both actual and expected inflation. That is, it is not sufficient for actual inflation to be low and stable; in addition, the monetary regime must be credible in the public's perception, as evidenced by measures of expected inflation for the medium and long terms. This definition is in the spirit of former Fed Chairman Greenspan's intuitive definition of price stability (Greenspan (2002), p 6): "... price stability is best thought of as an environment where inflation is so low and stable over time that it does not enter materially in the economic decisions of households and firms".

Although this definition does not explicitly mention expectations, it clearly implies that inflation expectations must also be low and stable for economic agents to be able to ignore inflation in their decisions. In the context of an inflation targeting

share of the variable interest rate component of each mortgage, as well as increasing capital charges for mortgage lenders.

regime, this means that observable measures of actual and expected inflation are consistent with the inflation target, in terms of both the level and the time horizon defined by the target.

In Israel’s case, Cukierman and Melnick (2015) (both former members of the MPC) make the case that the period of price stability begins at the end of 2003, when inflation expectations became well anchored by the inflation target (see Graph 6). This in spite of the fact that Israel’s monetary regime met the IMF definition of “full-fledged inflation targeting” already in mid-1997 (see Stone and Bhundia (2004)) and, as shown econometrically by Melnick and Stroshal (2015), actual inflation was generally within the target zone already by late 1998. But given Israel’s history of volatile inflation, it is not surprising that inflation expectations lagged both institutional developments and actual price movements. Perhaps surprisingly, the dating of price stability in Israel is nearly the same as Greenspan’s dating of the achievement of price stability in the United States (see Greenspan (2002) and Orphanides (2006)). It is interesting to note that for the period January 1999–August 2015, average 12-month inflation in the US and Israel were nearly equal, 2.14% and 2.27%, respectively, but the standard deviation was 1.9% in Israel while it was only 1.3% in the US.

Inflation expectations – one-year- and 10-year-ahead

1994–2015

Graph 6



### Institutional changes

Three major institutional developments in the “lead-up” period were of key importance in establishing the credibility required for sustained price stability. First, in September 1994, in the wake of the realisation that an ambitious inflation target would be missed by a wide margin for that year, the government approved the active use of domestic interest rate policy to attempt to attain the target (see Cukierman



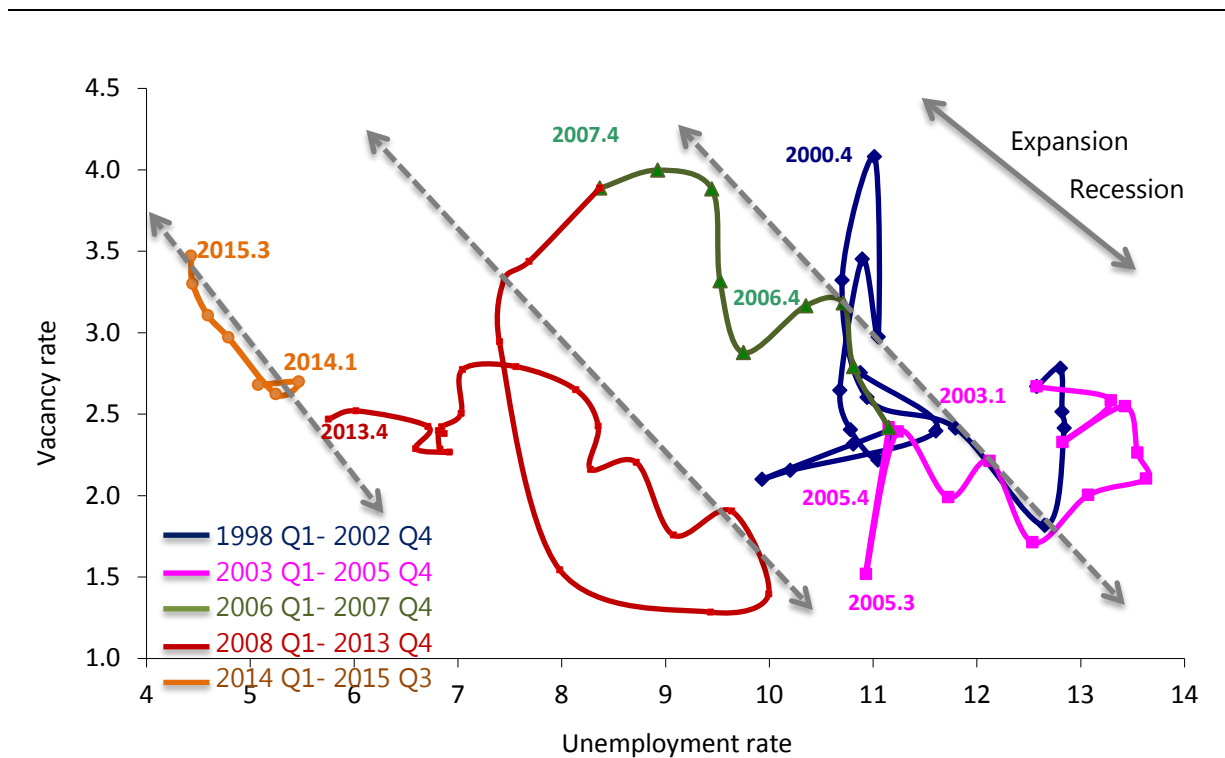
and Melnick (2015)). This was the first clear message sent by the authorities that a target is not just a forecast but a metric to be attained through explicit policy measures.

However, the government's reluctance to take the important complementary step of enabling exchange rate flexibility in combination with high interest rates relative to abroad led to a surge of capital inflows and massive forex intervention by the Bank of Israel. By June 1997, the Bank was able to convince the government that this situation was untenable, and the government approved the second key policy measure leading to price stability – a significant widening of the exchange target zone (ERTZ), creating a de facto fully flexible exchange rate policy regime. In addition to widening the ERTZ, the Bank of Israel and the government continued to pursue a gradual liberalisation of foreign exchange controls, first on the side of credit and then on the side of the public's assets. The disinflation process was temporarily interrupted in the fourth quarter of 1998 by a brief inflationary shock due to the Russian bond/LTCM crisis; the shock was offset by a large, immediate interest rate hike. This episode was important in establishing the credibility of the inflation targeting policy.

Stable conditions resumed and by mid-1999 the time was ripe for the third and final key policy measure leading to price stability: declaration by the government of a formal, long-term inflation target at the level that had been adopted as best practice by a significant number of advanced economies – an annual rate of approximately 2%. This announcement came in August 2000 as part of a government decision to adopt the European standard for macroeconomic management (see Bank of Israel (2001)), stipulating a gradual reduction of the inflation target over three years and setting by 2003 a target range of 1–3% for an indefinite horizon (see discussion in Cukierman and Melnick (2015), Section 5.)

### Structural changes – flexible labour markets

Israel's strong economic performance from mid-2003 to mid-2011 far outstripped the rate of growth in other advanced economies and was affected acutely by the global financial crisis during only the fourth quarter of 2008 and the first quarter of 2009. During this period, inflation fluctuated within and somewhat outside the target range, with misses attributable primarily to worldwide commodity price fluctuations. Labour markets since 2004 became more efficient as labour participation of the core age group (25–64) increased from 75.4% in Q1 2004 to 80% in Q3 2015 while unemployment fell from 11.7% to 4.5% in those quarters. These changes occurred with little increase in gross real wages, though the drop in personal income tax rates during the period generated higher net wages. In fact, the Beveridge curve relating the unemployment rate to the job vacancy rate seems to have shifted twice during the past decade, as can be seen in Graph 7, pointing to a more efficient labour market.



### Falling exchange rate pass-through

In a small open economy such as Israel's, the inflation rate can be expected to be affected by exchange rate movements in the short run, but in addition its history of high inflation gave rise to "Institutional arrangements designed to safeguard the real value of a unit of account...however, once established, dollarisation in the real estate market tended to persist long after stability made it no longer necessary", in the words of Cukierman and Melnick (2015). As can be seen in Graph 8, taken from the same authors, the percentage of dollar-denominated rental contracts fell from around 90% in 2005 to approximately zero today, with the steep fall occurring within one year between 2007 and 2008, roughly four years after Israel attained price stability.<sup>9</sup>

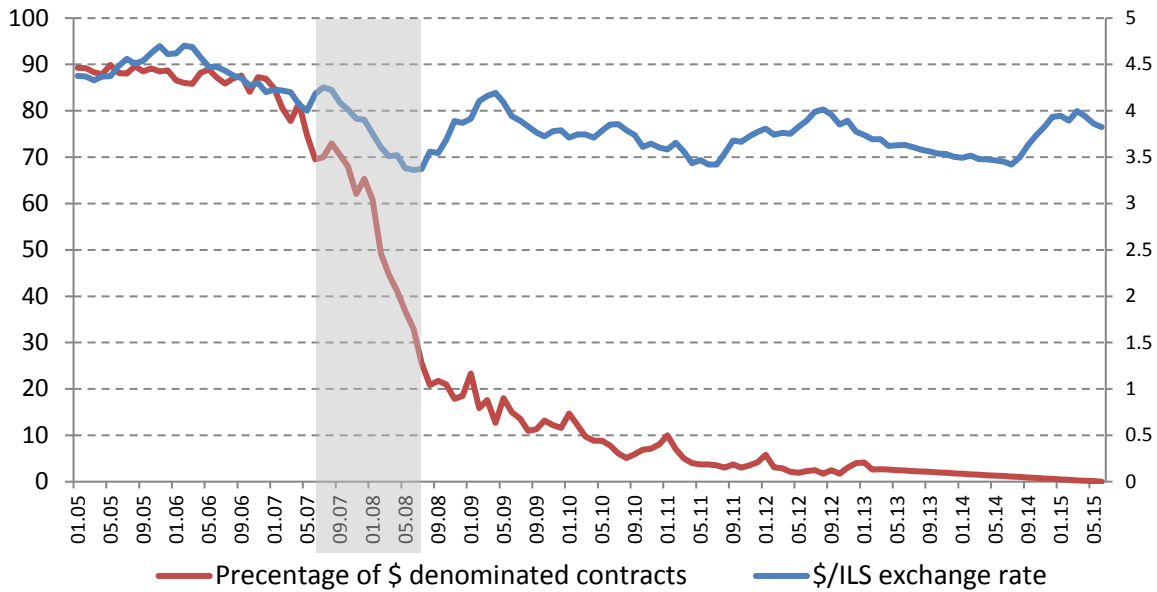
In the same article, Cukierman and Melnick estimate that the pass-through coefficient went from close to 1 between 1980 and 1998 to 0.09 in the period 2003–15. These results are consistent with estimates by Ribon (2015b) which find that the short-term pass-through of exchange rate movements to inflation has dropped from close to 80% 20 years ago to approximately 10% today. The pass-through from the exchange rate to the CPI excluding the housing component has dropped from about 47% to 5% over the same period, as can be seen in Graph 9. Note that this highlights the role of institutional elements enhancing the pass-

<sup>9</sup> Note that the fall also occurred roughly at the same time as the global financial crisis was developing in the US, with the shekel initially strengthening vis-à-vis the dollar, which may have accelerated the switch from dollar denominated contracts to shekel contracts.

through effect, which accounts here for half of the total effect in both the strong and weak pass-through effect periods.

Percentage of new dollar-denominated rental contracts (lhs) and USD/ILS exchange rate (rhs)

Graph 8

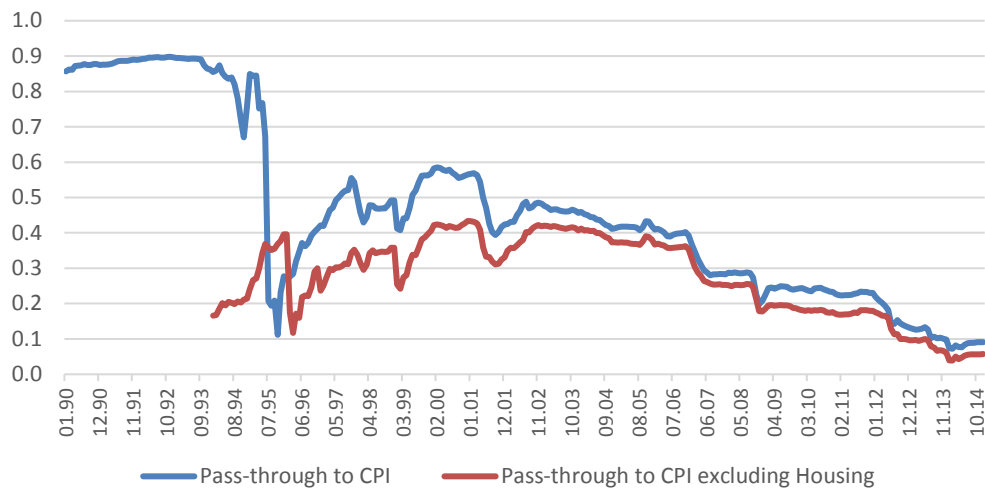


Source: Cukierman and Melnick (2015).

Pass-through coefficient from exchange rate to CPI and CPI excluding housing

1990–2014

Graph 9



Source: Ribon (2015b).

### 3. Inflation expectations and monetary policy

Another lingering effect of Israel's past history of high inflation lies in the still active CPI indexed bond market, which still accounts for about a third of the government's newly issued tradable debt, and approximately 70% of the corporate bond market. This has made it relatively easy to measure and interpret break-even inflation expectations, both short- and long-term, using indexed and unindexed bonds of various maturities. However, since fiscal responsibility and price stability have been achieved, the number of bond series issued by the government has declined, so measurement of inflation expectations increasingly relies on synthetically built yield curves, as in most other advanced countries. In addition, we look at forecasters' published figures for one-year inflation expectations, as well as break-even inflation calculated from commercial banks' internal interest rates, indexed and unindexed, that they calculate and use internally to price products to customers.

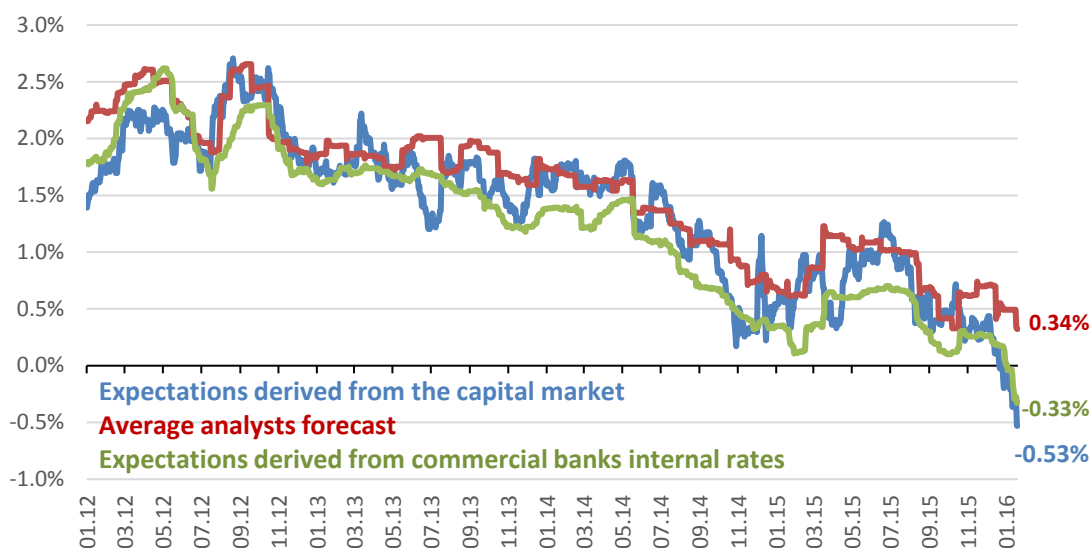
Graph 10 shows that a recent development has been a gradual but persistent drop in short-term inflation expectations, from all sources: professional forecasters, financial market-based and commercial banks' internal pricing. This has occurred while the economic environment has not changed markedly over the past year, though the most recent forecasts continue to point to an increasingly lacklustre level of economic growth – about 2.5%. The labour market, on the other hand, continues to show resilience, both on the job creation front and in the pace of nominal wage growth, which continues to increase at about 2–3% annually.

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#### One-year inflation expectations

Various sources, daily 2012–15

Graph 10



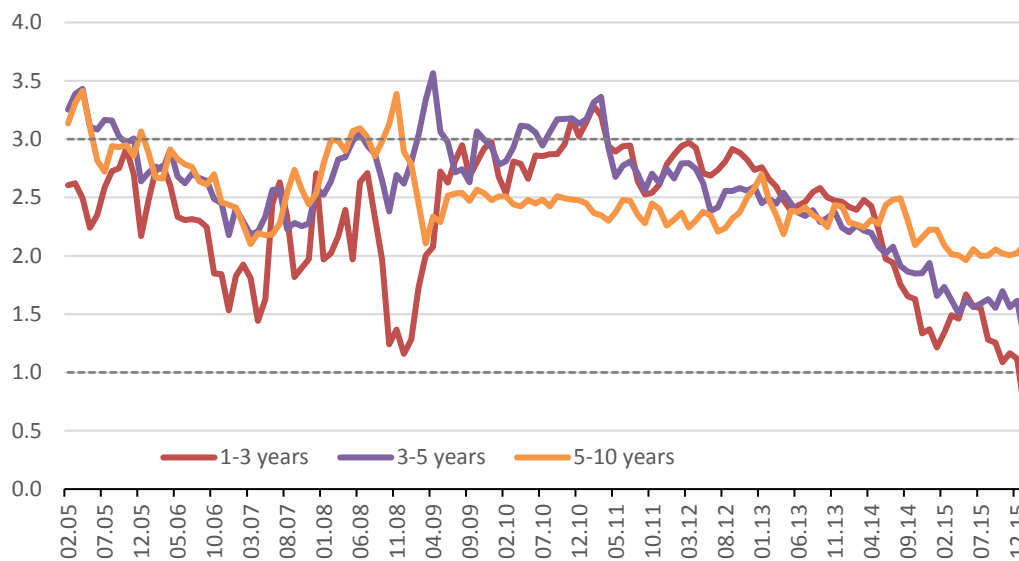
Note that due to the large one-off external shocks which have occurred recently, such as the reduction in VAT and the drop in water prices and other administrative measures, and given that these are announced ahead of time, Israel has increasingly been relying on forward inflation expectations, such as the one-year expectation one year ahead, in order to attempt to net out the effects of these shocks.

Graph 11 shows that long-term inflation expectations are well anchored around the middle of the inflation target (2%), the medium-term expectations have stabilised at a lower level (about 1.5%) but are still within the target range, and the short-term forward expectations have now dropped below the band for the first time ever, and stood at 0.7% in mid-January 2016. Clearly the market expects the very low inflation environment to remain so for a number of years ahead, which can no longer be explained by the one-off shocks mentioned above.

## Forward inflation expectations: short-, medium- and long term

2005–15

Graph 11



The accuracy of these various measures of short-term inflation expectations and forecasts over the past few years can be seen in Graph 12 and perhaps indicates their usefulness for monetary policy.

The various sources of expectations and forecasts move closely together and show some persistence in their deviation, which for the past few years has manifested itself as a systematic overestimation of future inflation.

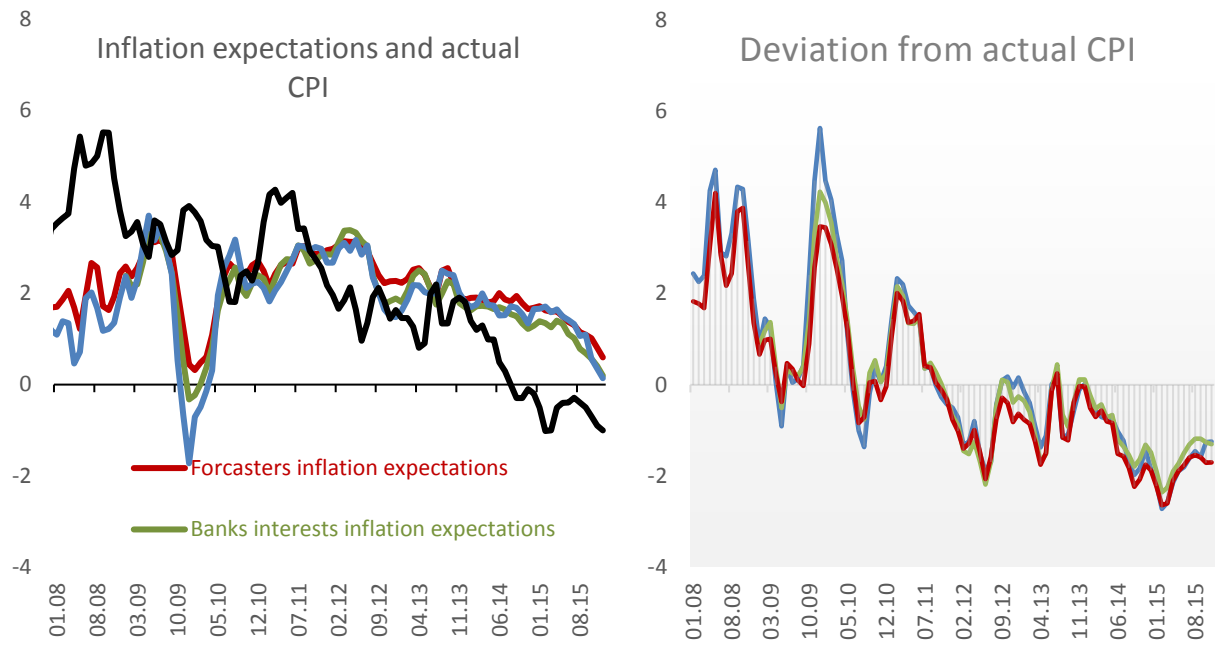
An interesting insight as to the source of these deviations has been suggested by Sussman and Zohar (2015), who investigate the changing role of oil prices in the formation of inflation expectations, both in Israel and other oil-importing countries. They note that oil prices have become more strongly correlated with five-year break-even inflation, as can be seen in Graph 13, despite the fact that oil is a relatively minor component of the CPI.<sup>10</sup>

<sup>10</sup> In Israel it is reflected mostly in the price of gas, which is heavily taxed and thus mitigates substantially the oil price movement.

## One-year inflation expectations and forecasts and actual CPI

Monthly, 2008–15

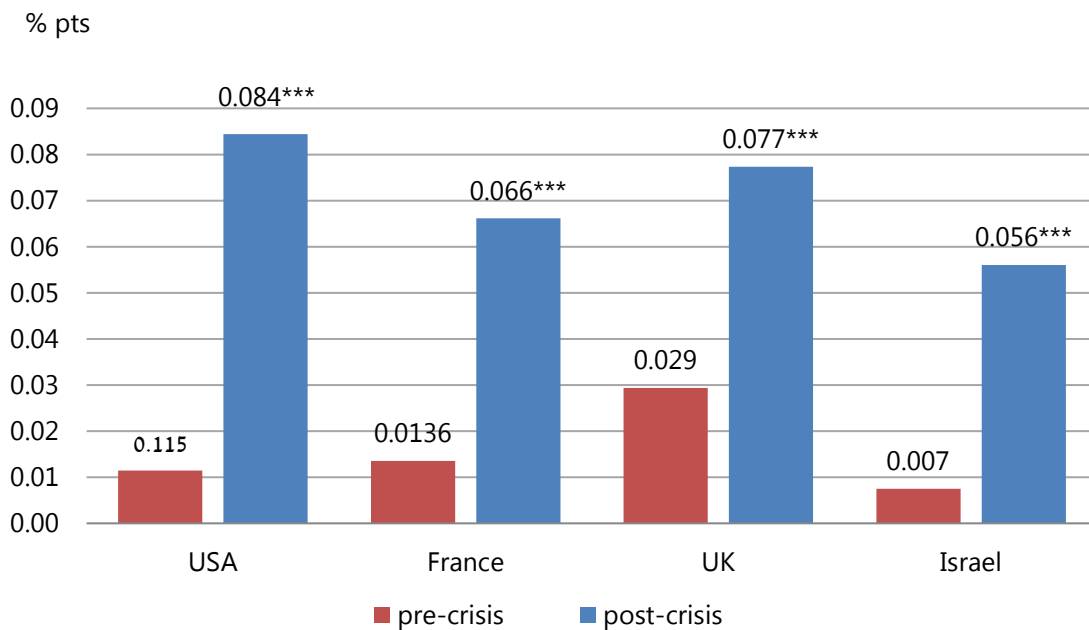
Graph 12



## Percentage point change in five-year break-even inflation rates caused by a 10% increase in oil prices

Monthly, January 2004–June 2015

Graph 13



Using principal component analysis on other commodity price movements (as well as weather patterns in the area of production), they decompose oil price movements into demand and supply shocks, in order to eliminate possible spurious correlation between oil prices and inflation expectations due to a global aggregate demand shock. They find: "During the crisis, we saw that global demand and supply conditions reflected in oil prices became strongly correlated with inflation expectations. Examining the contribution of these factors ... reveals that while both factors contribute more to the developments in inflation expectations since the onset of the crisis, global demand has a more dominant effect. In fact, it seems that in the post-crisis period global demand explains a substantial part of the development in global expected inflation."

## 4. Conclusion

Like many countries, Israel has been experiencing low and declining inflation and inflation expectations in the past few years, generally well below inflation target ranges considered consistent with price stability, while at the same time real economic activity has been relatively resilient. The main sources of this continuing low inflation environment include the very long and sluggish economic recovery from the global financial crisis and the sharp global declines in oil and other commodity prices since end-2013, though in Israel the real economy has been relatively resilient. Year-over-year monthly inflation has been negative for a year and a half, while inflation expectations have remained anchored within or near the inflation target range until recently. Having pursued highly expansionary monetary policies since the beginning of the crisis, monetary authorities in Israel and many other constituencies are somewhat hard-pressed to take further aggressive measures to reflate. The Bank of Israel bases this policy stance on a number of considerations: (i) primarily the assessment that the negative price shocks are due mainly to temporary, positive supply shocks, so inflation is likely to gradually return to a path consistent with the inflation target within the two-year horizon provided for in the Bank of Israel Law; (ii) uncertainty about the effectiveness and possible unintended side effects of further unconventional monetary policy measures, such as negative policy rates or significant local currency bond purchases; and (iii) concern about continuing house price increases. Looking ahead, the Bank will have to weigh the possible emergence of further indications of second-order deflationary expectations against the likely costs of yet more monetary expansion.

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