Economics Letters 150 (2017) 86–90

Contents lists available at ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

Rationality and seasonality: Evidence from inflation forecasts

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HIGHLIGHTS

- The study examines the seasonal pattern in expectations.
- We use Israeli survey forecasts of quarterly inflation without seasonal adjustment.
- Rationality is tested with respect to (trivial) information about calendar quarter.
- We find significant prediction biases, which differ across calendar quarters.
- Seasonal bias is strongest at shorter horizons and in a low inflation environment.

ARTICLE INFO

Article history:
Received 15 August 2016
Received in revised form
8 November 2016
Accepted 13 November 2016
Available online 16 November 2016

JEL classification:
D83
E27
E37
E47

Keywords:
Rational expectations
Survey forecasts
Seasonality

ABSTRACT

We examine the seasonal pattern in expectations, using a unique Israeli survey of quarterly inflation forecasts. Rationality is rejected with respect to (trivial) information about calendar quarter. Seasonal bias is strongest at shorter horizons and in a low inflation environment.

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1. Introduction

The rational expectations hypothesis has been extensively tested, using survey forecasts. The results were mixed, as reviewed in Pesaran and Weale (2006). Recent expectations models introduce various kinds of information rigidities (e.g. Mankiw and Reis, 2002, Sims, 2003), which can accommodate forecasting patterns observed in surveys (e.g. Coibion and Gorodnichenko, 2015).

This study exploits a special Israeli survey of inflation forecasts to examine the seasonal pattern in expectations, which was ignored in previous studies. In particular, we conduct rationality tests, which examine whether the seasonal components of quarterly inflation series are properly incorporated by forecasters.

Unlike the usual survey forecasts employed in the literature, which refer mostly to annual predictions or seasonally adjusted series, this study employs a unique survey of quarterly inflation forecasts aimed to predict the original series without seasonal adjustment, thus, enabling us to shed light on the seasonality issue in the context of rational expectations.

The survey was conducted at the firm-level in Israel, during times of great changes in the inflation process from very high to low inflation levels. This provides additional opportunity to examine if and how inflation forecasts have changed with the inflation environment.

Our main evidence demonstrates a correlation between forecast errors and the calendar quarter of the year, suggesting a failure of rationality hypothesis with respect to the seasonal component of inflation series. This failure is more pronounced in short-horizon predictions and in a low inflation environment.

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http://dx.doi.org/10.1016/j.econlet.2016.11.017
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2. Data

The survey was conducted since 1980Q1 until 2009Q1 among economists and business executives from industrial, commercial and financial Israeli firms.[1] In each quarter, participants forecasted quarterly CPI inflation rates (regular CPI, including all items), for the current quarter as well as one, two and three quarters ahead. Hence, there are four forecast horizons in the survey, which will be referred to as $h = 0, 1, 2, 3$.

During the survey period, the Israeli economy had witnessed dramatic changes in the inflation process. A closer look at the data presented in Fig. 1 reveals three distinct sub-periods:

i. 1980Q1–1985Q4—High inflation sub-period (30% quarterly average), ended by a successful stabilization program in the summer of 1985.
ii. 1986Q1–1996Q4—Moderate inflation sub-period (3.5% quarterly average) with a slow declining trend, due to active disinflation policies, especially in the second half of the 1990s.
iii. 1997Q1–2009Q1—Low inflation rates (0.65% quarterly average), characterizing developed countries.

As a consequence, the analysis below will be applied separately for these three distinctive sub-periods, as well as to the whole sample and the period after the stabilization program (1986Q1–2009Q1), which is much more homogeneous relative to the whole sample.

3. Empirical analysis

Before applying a formal test, an initial insight can be obtained by looking at Fig. 2, which compares seasonal components in actual and current quarter forecast series. These quarterly components are simply calculated by taking the average across time of the demeaned series, for each quarter of the year.[2]

The various graphs presented, which also refer to the distinctive sub-periods described above, show that seasonal components in the actual process seem to be poorly captured by the forecasters, especially after the stabilization program (since 1986). The most notable seasonal pattern in actual inflation is the negative component in Q1 and the positive component in the following Q2, which are considerably underweighted in the forecast series. It even takes the wrong sign in the case of Q1 in the second sub-period (1986Q1–1996Q4). Still, the question is whether this kind of errors is systematic in the sense of rational expectations hypothesis.

In order to test forecast rationality with respect to the seasonal pattern of inflation series, we run a simple regression in a similar spirit to efficiency tests common in the literature (e.g. Nordhaus, 1987):

$$A_{t+h} - F_{t,t+h} = \beta_1 \times Q1 + \beta_2 \times Q2 + \beta_3 \times Q3 + \beta_4 \times Q4 + e_t$$

where A_{t+h} is the actual quarterly inflation rate at time $t+h$, $F_{t,t+h}$ is the mean forecast made at time t for the inflation at time $t+h$ ($h = 0, 1, 2, 3$ as presented above), $Q1, \ldots, Q4$ are dummy variables for the calendar quarter of the year at time $t+h$ (e.g. $Q1$ equals 1 if $F_{t,t+h}$ forecasts the inflation rate that will be realized at the first quarter of the year) and e_t is the error term.

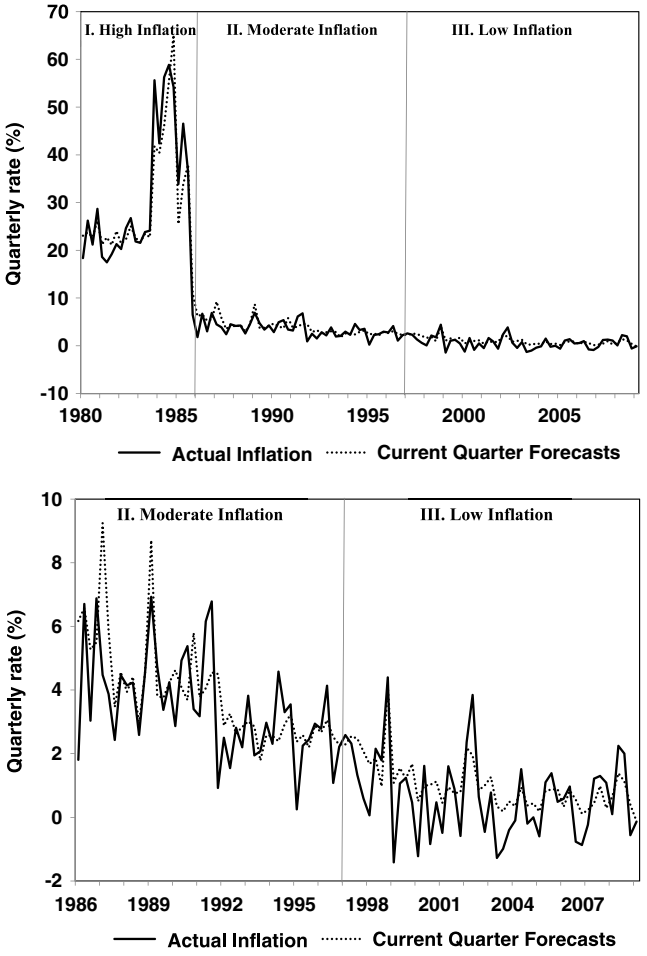

Fig. 1. Quarterly inflation rates and current quarter forecasts.

Thus, we just regress forecast errors on quarter-of-year dummies. Since quarter-of-year is certainly included in the information set of the forecasters, these dummies should be orthogonal to the forecast errors according to the rational expectations hypothesis. This should imply that all the βs should be equal to zero. In addition, we test the null that $\beta_1 = \beta_2 = \beta_3 = \beta_4$ to examine if a prediction bias is common across calendar quarters of the year, or represents an error related to the seasonal component in inflation process. The regression was estimated for each forecast horizon ($h = 0, 1, 2, 3$) and for the various relevant periods previously described.

The results, presented in Table 1, reveal several interesting patterns[3]:

(a) There are significant coefficients in most of the regressions, which violates rational expectations hypothesis.
(b) In most of the cases where rationality is violated, we can also significantly reject the equality of coefficients (by the Wald test), implying that biases in forecasts are different between calendar quarters of the year. This suggests that prediction biases are at least partly related to the seasonal component of inflation.
(c) Coefficients of each quarter dummy are quite similar across the different forecast horizons. Since the dummies were defined with respect to target quarter of the forecast, this indicates that seasonal biases are related to the target calendar quarter rather than the quarter in which the forecast was formed.

[1] Overall, 11 sectors of the Israeli economy are covered, including all major firms in each sector, with an average of 85 participants per-quarter. The survey was arranged by Ungar and Zilberfarb from Bar-Ilan University. Parts of the data were utilized in few former studies like Kandel and Zilberfarb (1999), which did not address the issue of the present study.

[2] This is equivalent to the coefficients from a regression of the demeaned series on dummies for the four calendar quarters (without a constant). Using more rigorous techniques for seasonal filtering, such as X-12, produces a very similar picture.

[3] Similar results were obtained when running panel regressions, with forecasts at the individual level.

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