REASONS OF UNDERSHOOTING THE INFLATION TARGET IN THE CZECH REPUBLIC: THE ROLE OF INFLATION EXPECTATIONS

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1. INTRODUCTION

The inflation targeting regime was introduced in the Czech Republic 10 years ago and there has been still a comparatively limited number of empirical studies explicitly attempting any evaluation as to whether and how such monetary policy regime has actually contributed to anchoring of the inflation expectations. The key purpose of this article is to estimate an extent to which the CNB’s inflation target and monetary policy have been impacting the inflation expectations, particularly in relation to frequent undershooting of the inflation target.

The “hypercredible” inflation target hypothesis, under which a 1 pp reduction would induce a decrease of inflation expectations by more than 1 pp in the long term, represents one of the inflation target undershooting options. Lower inflation expectations of economic subjects would then contribute to inflation stabilisation at the values below the inflation target. The inflation target, according to our econometric analysis, is a major determinant of inflation expectations, albeit nothing to support the “hypercredible” inflation target hypothesis has been found. Relying on the 1999–2007 data, our estimates have indicated that the 1 pp reduction of the inflation target would be on average accompanied by a 0.4 pp drop of the financial market inflation expectations for the inflation expectations during the 12-month horizon, and, by a 0.6 pp drop for the inflation expectations over the 36-month horizon.

This article also addresses relationships between inflation expectations, the target and other macroeconomic variables over a short-time period, using the impulse response analysis and variance decomposition within the block restriction vector autoregression model. We identify a statistically relevant decrease of inflation expectations in response to the stricter monetary policy and to the lower inflation target. The performed econometric analysis has on the overall indicated the credibility of the CNB’s monetary policy. While the key determinant of inflation expectations is represented by the foodstuff prices in the short term, it is the inflation target that impacts the inflation expectations development in the longer term. On the overall, the results indicate that the CNB’s monetary policy has anchored the inflation expectations.

The article is structured as follows: Section 2 contains a brief outline of the econometric model and data. Section 3 presents the results and Section 4 summarises the conclusions. An Appendix with additional results follows afterwards.

2. ECONOMETRIC MODEL DESCRIPTION

2.1 Vector error correction model

We have employed the vector error correction model (VECM) by Johansen and Juselius to evaluate the existence of a long-term relationship between the inflation target and inflation expectations, and other macroeconomic variables.

In the matrix form, the so-called reduced form VECM has the following form:

\[ \Delta y_t = \mu + \Pi y_{t-1} + \sum_{i=1}^{\Pi} \Delta y_{t-i} + \varepsilon_t \]  

(1)

where \( y_t \) denotes the vector of variables, \( \varepsilon_t \) vector of residuals, \( \mu \) vector of constants and \( \Pi \) is the matrix of parameters to be estimated. We estimate several specifications that differ depending on which variables are included in \( y_t \). The simplest specifications include only the inflation expectations, target and actual inflation, while the most comprehensive ones include the following variables: \( y_t = [\pi_t^{\text{food}}, \pi_t^{\text{food, y}}, \Delta \pi_t, \pi_t, \pi_t^{\text{com}}] \). \( \pi_t^{\text{food}} \) denotes the CNB’s inflation target (for the period during which the target was published only as a band, the mean value of the range is considered, while for the period during which the target was set as net inflation, respective values are adopted from the CNB’s main prediction model - the QPM), \( \pi_t^{\text{com}} \) represents commodity price inflation, \( \pi_t^{\text{food}} \) denotes foodstuff price inflation, \( \Delta \pi_t \) is the exchange rate change, \( \pi_t \) means the CPI inflation, and \( \pi_t^{\text{com}} \) denotes the market inflation expectations for 12, or, 36 months forward, and \( i \) means 3M PRIBOR.

2.2 Vector autoregression model under block restrictions

We have employed block restriction vector autoregression (Zha, 1999, Lutkepohl, 2005) to analyse short-term dynamic relations of the inflation target and inflation expectations – the model is defined as follows:

\[
\begin{bmatrix}
    y_{t-1}^1 \\
    y_{t-1}^2 \\
    \vdots \\
    y_{t-1}^{p_2}
\end{bmatrix} = \begin{bmatrix}
    A_{11} & 0 & \cdots & 0 \\
    A_{12} & 0 & \cdots & 0 \\
    \vdots & \ddots & \ddots & \ddots \\
    A_{1p_2} & \cdots & \cdots & 0
\end{bmatrix} \begin{bmatrix}
    y_{t-p_1}^1 \\
    y_{t-p_2}^2 \\
    \vdots \\
    y_{t-p_2}^{p_2}
\end{bmatrix} + \begin{bmatrix}
    0 \\
    0 \\
    \vdots \\
    0
\end{bmatrix} + \begin{bmatrix}
    \varepsilon_{t-1}^1 \\
    \varepsilon_{t-1}^2 \\
    \vdots \\
    \varepsilon_{t-1}^{p_2}
\end{bmatrix}
\]  

(2)

where vector \( y_{t-1}^i = [\pi_t^i] \), i.e. the vector includes only the CNB’s inflation target, while vector \( y_{t-p}^i \) includes the remaining variables, i.e. \( y_{t-p}^i = [\pi_t^{\text{food}}, \pi_t^{\text{food, y}}, \Delta \pi_t, \pi_t, \pi_t^{\text{com}}] \). The above block restriction prevents the inflation target from responding to the development of other variables. The block

\footnote{We determine the VECM model lags in a standard manner, using the Schwarz information criterion (SIC). In our case, the number of lags equals 1 or 2, subject to specification of the variable vector.}

3 A similar set of variables has been used by Holub and Humlík (2008) that, too, has addressed the inflation expectations analysis, using a simple vector autoregression model. In our paper, we have additionally introduced an inflation target under block restrictions which enables us to explicitly analyse the inflation target impact on inflation expectations. Since monthly-frequency data are used in the empirical section, no explicitly cyclical element has been included in the vector variable. Otherwise, a quarterly output gap to the monthly frequency would have had to be interpolated in order to set up a time series that would contain 2/3 of “artificially” generated observations, which is particularly problematic in dynamic models of the VAR type, as
3. Results

A long-term relationship (so-called cointegration vector) of the inflation expectations and other variables is presented in Table 1.\(^1\) It is apparent from the Table that an increase of the inflation target by 1 pp was accompanied by a drop of inflation expectations by approx. 0.3–0.5 pp over 12 months. In the 36-month horizon, the estimate indicates a somewhat higher value, by about 0.6 pp. Further, we can see that a long-term relationship exists of the development of overall inflation and inflation expectations. In addition, Table 1 points to the fact that the exchange rate appreciation was accompanied by lower inflation expectations. It follows from the estimated coefficients that the exchange rate appreciation by 1 pp was accompanied by a drop of inflation expectations by approx. 0.03 or 0.04 pp, a surprisingly low impact. We can also see that the interest rate setting is related to the inflation expectations. Higher rates may be expected during the higher inflation expectation periods (even though the relationship is statistically insignificant for the 36-month horizon expectations). Foodstuffs price inflation is not significant for the inflation expectations development in the long-term (while it is significant in the short term, see below). Commodity price inflation, too, appears not highly relevant for the inflation expectation creation in the long-term horizon (the relationship is not statistically significant in one case, while it is significant in another, but the estimated coefficient has the opposite sign), which is not exactly surprising given the variable’s volatility.

![Figure 1: Inflation expectations (12- and 36-month horizon) and the inflation target](image)

**Note:** The inflation 12- and 36-month expectations have been shifted forward by 1 and 3 years respectively to compare with the CNB’s inflation target.

\(^{1}\) Relevant tests have indicated the existence of a single cointegration vector.
Next, we present estimates below for the above described block restriction VAR model, in a standard form of impulse responses and variance decomposition (as noted above, this model, as opposed to the previous model, is better suited to analyse short-term relationships). Figure 2 shows the impulse response by the inflation expectations to the shock caused by the remaining variables within our model. As the results imply, lower inflation target induce the inflation expectations to decrease in a statistically significant manner (see the image top left of the Figure), which suggests that the CNB’s inflation target had been anchoring the financial market inflation expectations over the period under review (which supports the conclusions arrived to by Holub and Hurník, 2008). An increase in commodity price inflation has no statistically significant impact on the inflation expectations (confidence intervals are too wide). Higher foodstuff price inflation leads to a short term increase in the inflation expectations (the increase is statistically significant over an approximate 12-month horizon). The VAR model results point also at the significance of the exchange rate fluctuations in creation of the inflation expectations. The exchange rate depreciation leads to higher inflation expectations: the effect is statistically significant approximately 3 or 9 months after the exchange rate shock. According to the results, a CPI inflation increase has initially no significant impact on the inflation expectations, while the inflation increase within approximately 18 months is accompanied by lower inflation expectations. This may reflect the fact that economic subjects expect lower inflation in future due to an expected response of the monetary policy to higher inflation. Similarly, a increase of interest rates is teams with a significant decrease of the expectations as the market is expecting a drop in future inflation as a response to introducing a more restrictive monetary policy (once again, the response of the inflation expectations is significant after approx. 6 quarters, which presumably reflects perception of the CNB’s monetary policy horizon). The foregoing, in addition to the inflation target effect on the inflation expectations, may be interpreted as another evidence of a credible monetary policy. The Appendix presents additional impulse responses (inflation response to the monetary policy shock and to the inflation target). The results indicate that a monetary restriction induces lower inflation, while a lower inflation target is accompanied by lower inflation.

In Figure 3, we present the results with the 36-month inflation expectations (the rest of the model remains unchanged). These results support quite a degree of revaluation of the result in Figure 2 (inflation expectations within the 12-month horizon). The inflation target has a systematic effect on the inflation expectations. The market shows somewhat surprising revaluation of its inflation expectations depending on the foodstuff prices even within the above horizon (although the impulse response is significant in the short term only). Current exchange rate fluctuations are impacting creation of the inflation expectations, exchange rate depreciation leads to a decrease in expected inflation (the effect presumably reflects the expectations of the financial market that the current exchange rate depreciation will result in higher inflation forecast by the central bank and that the bank will then respond by higher interest rates and those will subsequently reduce inflation with a delay and accordingly also the 36-month inflation expectations). The development of current CPI inflation and the interest rate setting does not seem to be so important in terms of their impact on the 3-year ahead expectations.

Figure 2: Inflation expectations (12-month horizon): Impulse responses, Block restriction VAR

Note: The x axis shows time in months. The full line shows the impulse response, the dashed lines represent a 95% confidence interval computed using the Efron bootstrap method (it may be said then that the inflation expectation response is statistically significant in a given month providing both of the confidence intervals are positioned either below or above the x axis). Identification of shocks uses the Cholesky decomposition.
creation of the inflation expectations is supported also by the newly available data from the turn of 2007–2008 that show an increase in the inflation expectations in the light of a high increase of the foodstuff prices. The significance of the commodity prices and overall inflation records less than 10%. It may supposed due to the low impact of the commodity prices that the market did not expect any significant second-round effects of the commodity prices on inflation. The residual variability relates to the inflation expectations per se.

Figures 4 and 5 present variance decomposition for the inflation expectations within the 12- and 36-month horizon respectively. It follows from Figure 4 that the short-term variability of the 12-month inflation expectations is based on the foodstuff price inflation variability by approx. 20–25%, change of the inflation target by 10% and monetary conditions by 15% (the exchange rate significance exceeds that of the interest rates). A considerable relevance of the foodstuff prices for
4. Conclusion

This article initially addresses the role of the inflation target with respect to inflation expectations developments using the vector error correction model (VECM) and block restriction vector autoregression (VAR), based on the monthly data of 1999–2007. The econometric analysis performed has not identified any grounds in support of the “hypercredible” inflation target hypothesis, under which a 1 pp decrease would be accompanied by a decrease of inflation expectations by more than 1 pp. The results however suggest that the inflation target is a major determinant of inflation expectations, its significance for creating the inflation expectations surpassing even that of the current inflation development. Another conclusion is that the inflation expectations show a significant statistical decrease when responding to a stricter monetary policy and to the inflation target decrease. On the overall, the results indicate that the monetary policy has anchored the inflation expectations.

References


APPENDIX: ADDITIONAL IMPULSE RESPONSES

Inflation expectations (12-month horizon): Impulse responses,
Block restriction VAR

Response of inflation to interest rate

Response of inflation to inflation target

Inflation expectations (36-month horizon): Impulse responses,
Block restriction VAR

Response of inflation to interest rate

Response of inflation to inflation target