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Deflation risk in the euro area and central bank credibility[☆]

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HIGHLIGHTS

- We use a novel dataset on perceived deflation risk using options on forward inflation swaps.
- Market perceptions of deflation risk in the euro area evolved during the period 2010–2015.
- Longer-term deflation risks became more sensitive to changes in oil prices and inflation surprises.
- The anchoring properties of euro area inflation expectations may have subtly weakened.

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ABSTRACT

We analyze a new option-based indicator of market perceptions of euro area deflation risks. We find that during 2010–2015, long-term deflation risks became slightly more sensitive to oil price changes and inflation surprises, suggesting a subtle weakening in anchoring.

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1. Introduction

Over the past years, central banks in many advanced economies have faced persistently low and sometimes even negative inflation. In parallel, inflation expectations at different horizons have been well below monetary authorities' inflation targets. In explaining this phenomenon, much attention has focused on the sharp fall in commodity prices, most notably oil prices, between 2014 and 2016 (International Monetary Fund, 2016). For central banks it is crucial to understand if the behavior of expectations reflects a weakening in the anchoring of inflation expectations, which would imply lower monetary policy credibility and thereby less effective monetary policy.

[☆] The views expressed in the paper are those of the authors and not necessarily the views of the Bank for International Settlements or De Nederlandsche Bank.

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In spite of its crucial relevance for policymakers and a rich research literature, the anchoring of inflation expectations has remained an open issue (Mavroeidis et al., 2014). This is due to an important extent to the difficulties in measuring inflation expectations. This puts a premium on new evidence on the anchoring properties of inflation expectations, and particularly on exploring the information content of new types of data.

This is the main motivation of our paper. We analyze a novel dataset on market participants' perceptions of deflation risks at different horizons in the euro area, which is based on year-on-year options on forward inflation swaps. We use these data to test whether long-term deflation risk has been affected by changes in oil prices or by inflation surprises.

Our paper blends two recent literature streams. The first explores whether the behavior of different types of measures of inflation expectations has changed since the onset of the global financial crisis. It has increasingly focused on the information content of higher moments of the probability distribution of expectations. It relies either on survey measures of inflation expectations

(e.g. [Dovern and Kenny, 2017](#); [Łyziak and Paloviita, 2016](#)) or on measures derived from derivatives prices, such as inflation-linked swaps (e.g. [Speck, 2017](#)) or inflation-linked options ([Scharnag and Stapf, 2015](#); [Natoli and Sigalotti, 2018](#)). The second literature strand has documented the impact of oil prices on inflation expectations at different horizons (e.g. [Beechey et al., 2011](#); [Sussman and Zohar, 2015](#)).

2. Measuring deflation risk

The recent growth in inflation options markets offers a new opportunity to explore the probability density of inflation expectations. This is particularly useful in the analysis of perceptions of tail risks, such as the risk of deflation.

The two most common of these options are zero coupon (ZC) and year-on-year (YOY) inflation options. The former are contracts written on the average inflation rate over their lifetime, for example, between the start of the contract and five years thereafter. Long-term deflation risk can be recovered only as an average over short- and long-term deflation risk. Pinning down densities for forward inflation over specific future dates would then require further assumptions ([Kitsul and Wright, 2013](#)). The latter are a basket of multiple, so-called caplet/floorlet options, with an identical strike price but with different maturities. For instance, a 5-year YOY cap is a series of five independent options (caplets) maturing at annual intervals. Deflation risk over longer horizons can therefore be recovered directly, rather than as an average of over short- and long-term deflation risk.

The Royal Bank of Scotland (RBS), a major player in the market for inflation options, has provided us with data on option-implied inflation probabilities regarding one-year forward inflation rates ending 2, 3, 5, 7 and 10 years ahead. These probabilities are based on the bank's own calculations and rely on the prices of YOY euro HICP (ex-tobacco) inflation caps and floors. Unlike most of the literature, therefore, we rely on data extracted from YOY, rather than ZC, inflation options. The probabilities were calculated for the corresponding forward rates being in one of the following probability buckets: [$\leq -1\%$], [$-1\%, 0\%$], [$0\%, 1\%$], [$1\%, 3\%$], [$3\%, 4\%$], [$4\%, 5\%$] and [$\geq 5\%$]. The focus of our paper is on the first two buckets, which capture market perceptions of deflation risk for different horizons. The dataset runs from January 2010 to December 2015.

A useful feature of our data is that it comes directly from one of the main market players, rather than reflecting indicative prices quoted by brokers, as are typically used in the literature. These data provide a novel indicator of market perceptions of deflation risk.

As any market-based measures of deflation risk, our option-implied probabilities must be considered with caution, since they are affected by liquidity and risk premia, and other factors unrelated to expectations of future price changes. We deal with this important issue in two ways. First, we take monthly averages of our daily data on deflation risk. The idea is that while day-to-day changes in implied deflation probabilities based on option prices may be noisy, these contracts contain useful information about lower frequency movements ([Smith, 2012](#)). Second, in our econometric tests we use control variables that have been used in the literature to capture technical factors unrelated to expectations.

3. Empirical method and results

To assess whether inflation expectations have remained well anchored, we examine whether market perceptions of deflation risks at different horizons implied by inflation options react to oil prices and inflation surprises. The sharp decline in oil prices between 2014 and 2016 has been seen as a primary factor behind the decline of inflation and inflation expectations. But oil prices are not the sole primary driver of inflation expectations, and other

macroeconomic shocks may be at least as important (e.g. [Conti et al., 2015](#)). We therefore include as explanatory variables surprises of macroeconomic data releases aggregated over one month, in the form of the Citigroup inflation surprise index, taken from Bloomberg. The index is defined as weighted historical standard deviations of data surprises (actual releases minus Bloomberg median survey expectations). A positive reading suggests that data releases have on balance been higher than median survey expectations.

If long-term deflation risk reacts to changes in oil prices or to inflation surprises, this would provide evidence of a weakening of the anchoring of long-term inflation expectations, reflecting a loss in the ECB's credibility in achieving price stability. To test this, we regress monthly changes in deflation risk at horizons of $m = 2, 3, 5, 7$ and 10 years ahead, $\Delta f_t^m = f_t^m - f_{t-1}^m$, on a constant, month-on-month percentage changes in oil prices (West Texas Intermediate in US dollars per barrel), Δoil_t , the Citigroup euro area inflation surprise index, isi_t , and the Citigroup global inflation surprise index, isi_t^g ,

$$\Delta f_t^m = \alpha + \beta \Delta oil_t + \gamma_1 isi_t + \gamma_2 isi_t^g + \delta \Delta VSTOXX_t + \varepsilon_t \quad (1)$$

where we control for changes in risk and liquidity premia by including $\Delta VSTOXX_t$, the month-on-month percentage change in the VSTOXX financial volatility indicator for the euro area, a measure of implied volatility for options on the EURO STOXX 50 equity index from Bloomberg commonly used in the literature to control for changes over time in risk and liquidity premia. If β , γ_1 or γ_2 are significantly different from zero for longer horizons, this would suggest that inflation expectations are not firmly anchored.

We first estimate Eq. (1) over the whole sample period. We find that deflation risk 2 to 3 years ahead reacts most significantly and most strongly to oil prices ([Table 1](#)). At a horizon of 5 to 7 years, deflation risk also reacts significantly to oil prices, but less strongly than at shorter horizons, while deflation risk 10 years ahead is not sensitive to changes in oil prices.

We then test whether the anchoring of inflation expectations has changed over time, by re-estimating Eq. (1) separately for the first and the second half of the sample period. We find that there has been a visible change in the dynamics of deflation risks over time ([Table 1](#)). Between 2010 and 2012, oil prices were important drivers of shorter-term deflation risk (2 and 3 years ahead) but not of deflation risks over longer horizons (5 to 10 years ahead). Over the past few years, however, deflation risks 5 to 10 years ahead have come to react significantly to oil prices. Moreover, consistent with these results, we find that the euro area inflation surprise index is not significant for long horizons in the first period, but that it is significant at horizons of 7 and 10 years ahead in the second period, consistent with inflation expectations having become less well-anchored in the second period. The global inflation surprise index is not significant in any period.

As a robustness check, we find that very similar results obtain when instead of the VSTOXX we include the VIX index, a measure of implied volatility for options on the US S&P 500 equity index from Bloomberg, which is commonly used in the literature as a proxy for global financial market uncertainty.¹

4. Conclusions

This paper explores what the evolution of market perceptions of the risk that the euro area will experience deflation implies for the credibility of the ECB. We use a novel dataset on perceived deflation risk implied by year-on-year options on forward inflation swaps. We present evidence that in recent years, longer-term

¹ The results are available upon request from the authors.

Table 1
Reaction of deflation risk to oil prices and inflation surprise indices.

<i>m</i> years ahead	2	3	5	7	10
January 2010–December 2015					
<i>constant</i>	0.20	0.25	0.36	0.34	0.30
Δoil	−0.15***	−0.12***	−0.04*	−0.03*	−0.02
<i>isi</i>	0.001	0.003	−0.01	−0.01	−0.02
<i>isi</i> ^g	0.02	0.02	0.04	0.04	0.04
$\Delta VSTOXX$	0.01	0.01	0.01	0.0002	−0.01
Adj. R^2	0.21	0.27	0.002	−0.01	−0.02
No. of observations	71	71	71	71	71
January 2010–December 2012					
<i>constant</i>	0.34	0.37	0.46	0.35	0.34
Δoil	−0.23**	−0.16***	−0.05	−0.002	0.01
<i>isi</i>	−0.01	−0.01	−0.01	−0.01	−0.02
<i>isi</i> ^g	0.07	0.05	0.05	0.01	0.04
$\Delta VSTOXX$	−0.01	−0.02	−0.01	0.01	0.001
Adj. R^2	0.30	0.16	−0.09	−0.12	−0.11
No. of observations	35	35	35	35	35
January 2013–December 2015					
<i>constant</i>	0.31	0.33	−0.59	−0.45	−0.41
Δoil	−0.11**	−0.11***	−0.04*	−0.04***	−0.03**
<i>isi</i>	0.005	0.002	−0.02	−0.02**	−0.02*
<i>isi</i> ^g	0.01	0.02	0.002	0.02	0.005
$\Delta VSTOXX$	0.04	0.05**	0.04***	0.002	−0.01
Adj. R^2	0.11	0.47	0.22	0.14	0.01
No. of observations	36	36	36	36	36

Newey–West adjusted standard errors.

* Significance at the 10% level.

** Significance at the 5% level.

*** Significance at the 1% level.

deflation risks have become more sensitive to changes in oil prices and euro area inflation surprises, suggesting that the anchoring properties of euro area inflation expectations may have weakened, albeit in a still subtle way.

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