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## Reading between the lines – uncovering asymmetry in the central bank loss function<sup>1</sup>

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<sup>1</sup> This contribution was prepared for the conference. The views expressed in this publication are those of the authors and do not necessarily represent the official views of the Committee, its members, or the BIS.

# Reading between the lines – Uncovering asymmetry in the central bank loss function

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# Background

- ▶ In macroeconomic models, it is typically assumed that central bank (CB) preferences can be summarised through a loss function.
  - ▶ The loss function is usually assumed to be quadratic, U-shaped and **symmetric**: the CB has an equal dislike of high and low inflation.
  - ▶ However, a welfare-based loss function may exhibit **asymmetries**.
- ▶ We apply **text analysis** to directly estimate the ECB's loss function during its first two decades.
  - ▶ Was the ECB's loss function **symmetric** or **asymmetric**?
  - ▶ *"Below, but close to, 2%"*
  - ▶ **Text data**: ECB introductory statements Jan 1999 – June 2021.

# Lexicon-based sentiment analysis

- ▶ We use Loughran and McDonald (2011) finance-specific dictionary...
- ▶ .. which we modify to better suit the ECB's communication
  - ▶ British English
  - ▶ add sentiment words, remove sentiment words
  - ▶ bigrams, trigrams
  - ▶ negations
- ▶ We define the **tone index** as the difference of the number of negative and positive words, normalized with the total number of words in the ECB introductory statement:

$$N_t = \frac{\#Neg - \#Pos}{\#Tot}$$

# Sentiment analysis with FinBERT language model

- ▶ FinBERT is a language model tailored for financial texts and designed for sentiment analysis.
- ▶ FinBERT assigns the probability that a text is positive, negative or neutral.
- ▶ With FinBERT we can compute a **context-aware tone index**.

# Scored example text

## Introductory statement from 6.10.2011

### Example: Positive, Negative

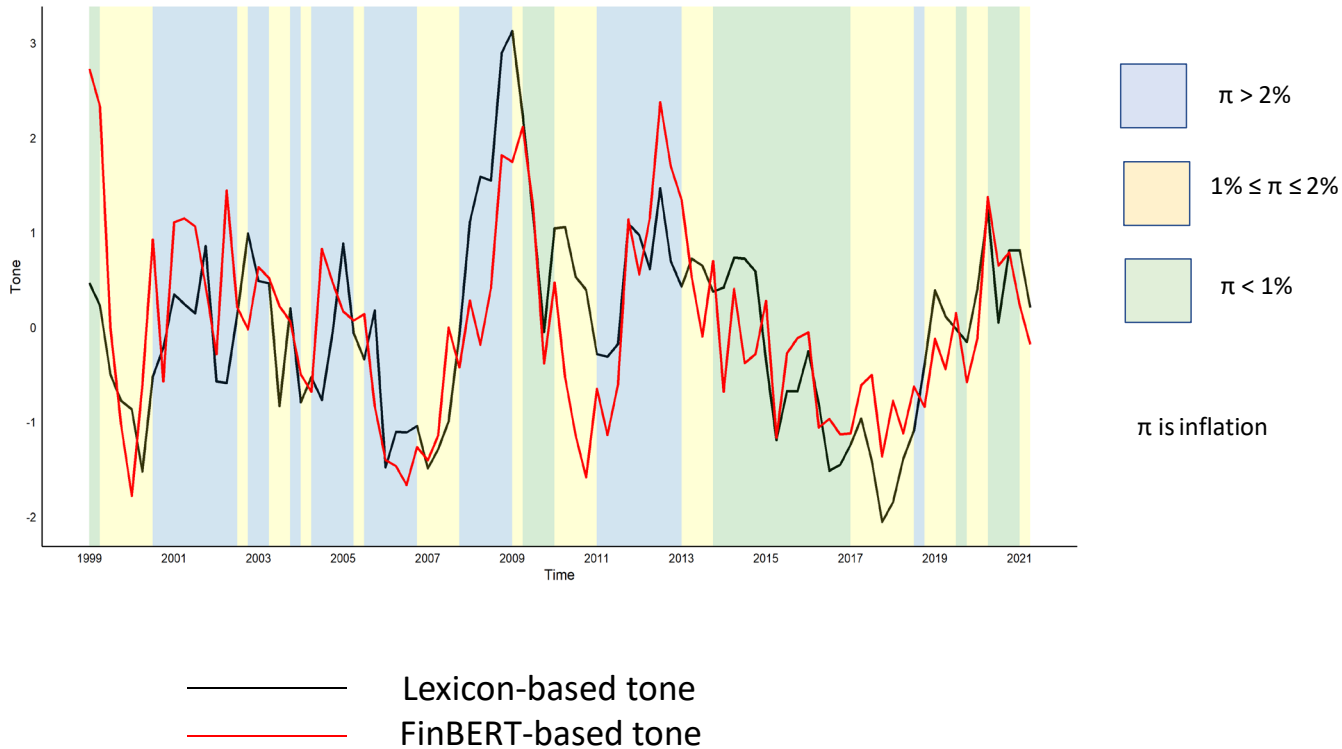
*'Let me now explain our assessment in greater detail, starting with the economic analysis. Real GDP growth in the euro area, after slowing in the second quarter of 2011 to 0.2% quarter on quarter, is now expected to be very moderate in the second half of this year. In particular, a number of factors seem to be dampening the underlying growth momentum in the euro area, including a moderation in the pace of global demand, falling consumer and business confidence, and unfavourable effects on financing conditions resulting from ongoing tensions in a number of euro area sovereign debt markets. At the same time, we continue to expect euro area economic activity to benefit from continued positive growth in the emerging market economies as well as from the low short-term interest rates and the various measures taken to support the functioning of the financial sector.'*

Positive      Negative      Neutral      sentiment

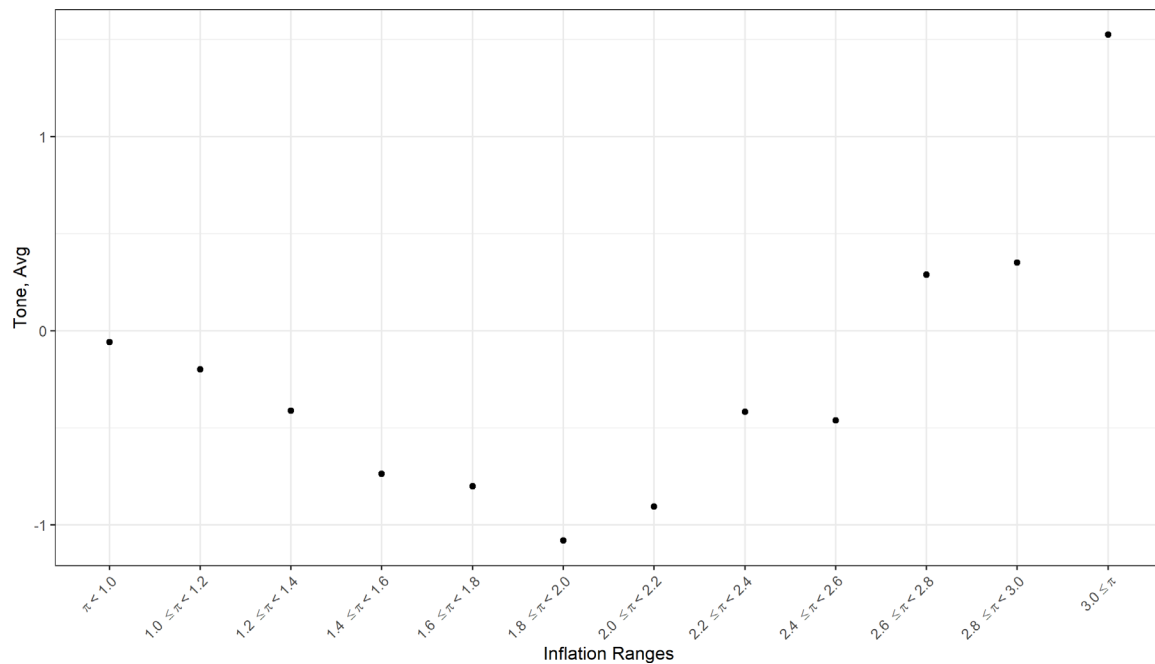
0,15584138    0,801850557    0,042308003    negative

- ▶ The lexicon-based approach detects 2 positive and 4 negative sentiment words.
- ▶ FinBERT assigns a high probability to the paragraph's sentiment being negative.

# Tone and inflation



# Non-parametric estimate of the loss function



- Average tone in inflation buckets

# Parametric estimates of the loss function

- ▶ Piecewise linear loss function (V-shaped)
- ▶ Linear exponential loss function (Linex; U-shaped)
- ▶ Control variables
  - ▶ real activity (unemployment, growth rate)
  - ▶ financial markets
  - ▶ economic uncertainty
- ▶ F-tests and LR-tests suggest **asymmetric** loss function.
- ▶ **Slope** is at least **3 times steeper** above the target than below the target.
- ▶ ECB disliked high inflation much more than low inflation.

# Robustness checks

- ▶ Tone measure
  - ▶ Tone based on inflation texts ([topic modelling](#))
  - ▶ Forward-looking and backward-looking tone ([GPT 4.0](#))
- ▶ Sample period
  - ▶ Start from 2003
  - ▶ Leave out the ELB period
- ▶ Inflation measure
  - ▶ Lagged inflation
  - ▶ Inflation forecasts
- ▶ Control variables: adding e.g. stock market variables
- ▶ The robustness checks support the view that the **ECB's loss function was asymmetric**.