

## Introduction

- We developed an advanced AI assistant for the European Central Bank (ECB), designed to help analysts, policymakers, and the public quickly access information from ECB press releases.
- The system is built on Graph Retrieval-Augmented Generation (GraphRAG), which extends traditional RAG by retrieving from knowledge graphs rather than unstructured text.

## Methods

### Model & Extraction

- Upgraded from DeepSeek → Gemini 2.5 Pro, producing richer relations and evidence spans.
- Modified and refined prompts to guide extraction, with rules to avoid noisy outputs: removed pronouns, year-only mentions, duplicate entity variants, and non-noun nodes.

### Noise Control & Canonicalization

- Dual-layer filtering: prompt-level + code-level to eliminate self-loops and generic spans.
- Entity merging: aligned abbreviations with full names (e.g., ECB & European Central Bank) while accumulating timestamps for temporal accuracy.

### Graph Construction

- Designed a multi-directed graph, allowing multiple relations or time-specific edges between the same entities without overwriting.
- Dates treated as edge attributes instead of standalone nodes, enabling chronological tracking of ECB decisions and events.

## Evaluation

**Example Question:** What is the ECB's monetary policy?

**Reference Answer:** The ECB's monetary policy encompasses all measures to influence the cost of borrowing that can be taken to meet our price stability objective. Our primary monetary policy instrument is the set of key ECB interest rates. Any change in these rates affects other interest rates across the whole euro area economy, including the rates at which commercial banks lend money to individuals and companies. These rate changes affect the demand for goods and services, which has an impact on inflation – with a time lag. If necessary, we can also use other tools to help us achieve our primary objective of price stability.

**Graph 1 answer:** Based on the provided context, the European Central Bank's (ECB) monetary policy is a comprehensive framework that guides the bank's actions to achieve its economic objectives. The ECB's monetary policy stance is assessed by the Governing Council, typically at the first meeting of the month, unless circumstances warrant an earlier assessment.

**Graph 2 answer:** The European Central Bank's (ECB) monetary policy is a comprehensive framework that aims to promote the stability and efficiency of the euro area's financial system. The ECB's monetary policy is designed to ensure the smooth transmission of its policies across all jurisdictions of the euro area, particularly in times of heightened geopolitical tensions or economic uncertainty.

### QA Evaluation (ECB/EIB FAQ, 100 questions)

Metrics	Old Graph	New Graph
Lexical overlap (Jaccard)	0.117	0.118
Semantic similarity (BERT)	0.657	0.672
Weighted comprehensive score	0.455	0.462
Runtime (s)	6.06	6.14

## Conclusion

- Successfully reduced noisy nodes and eliminated self-loops.
- Prevented dates from appearing as standalone entities, improving clarity and readability.
- Preserved parallel relations with timestamps, making the graph closer to the source text.

## Future Work

- Embedding-based merging of semantically similar nodes.
- Systematic edge validation to filter weak relations.
- Automated date normalization to enforce consistency.
- Continued refinement of prompts to reduce parsing errors.

