

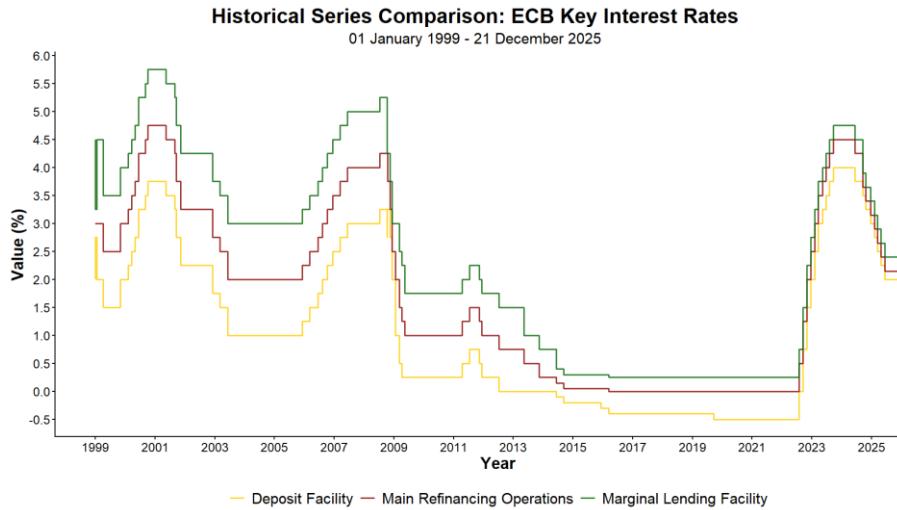
# Data Visualization Pitch

**From Negative Interest Rates to All-Time Highs: Detailed Analysis of the Key ECB  
Interest Rates Trends (01 January 1999 – 21 December 2025)**

**Emily Perillo**

# Data Visualization Pitch

## Emily Perillo



The following work highlights the evolution of:

- *Deposit Facility Rate.*
- *Main Refinancing Operations Rate*, both with its fixed option and variable option adopted from 2000 up to the 2008 financial crisis.
- *Marginal Lending Facility Rate.*

These financial instruments are the main tools used by the *European Central Bank* to deal with inflation and permit European economic prosperity.

# How has the ECB handled the Key Interest Rates policy throughout the years?

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## Research questions

This work has the purpose to highlight the changes of the three Key Interest Rates introduced by the European Central Bank by investigating *the evolution of the European Monetary policy.*

To pursue this objective, the research also deepens the following matters:

- In which periods they were stable and, most importantly, in which times they were not and the underlying causes.
- Whether or not the Key Interest Rates tend to follow the same trend.
- How quickly the Interest Rates adapt following a variation of its main contemporary perturbing force: *inflation.*

## About Data

The research has been conducted using the following datasets:

- **Main refinancing operations - fixed rate tenders (fixed rate) (date of changes)** - Level, Euro area, Daily (available at: [Fixed MRO Dataset](#)).
- **Main refinancing operations - variable rate tenders (minimum bid rate) (date of changes)** - Level, Euro area, Daily (available at: [Variable MRO Dataset](#)).
- **Deposit facility - date of changes (raw data)** - Level, Euro area, Daily (available at: [DF Dataset](#)).
- **Marginal lending facility - date of changes (raw data)** - Level, Euro area, Daily (available at: [MLF Dataset](#)).
- **Harmonized Index of Consumer Prices - Overall index, Euro area, Monthly** (available at: [HICP Dataset](#)).

All the content published on the ECB website is of **free use**, with the following **limitations**:

- The European Institution has to be cited as a source.
- The links affiliated to their datasets must load into the browser's entire window.
- Whenever their data has been used in documents which are sold or are part of a paid subscription, the users must be informed that these pieces of information can be acquired for free on the ECB official sources.
- If the datasets have been modified in any way, it must be explicit.

Because the data is collected by the European Central Bank, the datasets were complete and did not require any data cleaning operation. However, while Key Interest Rates are deterministic policy variables, the Harmonized Index of Consumer Prices data remains subject to inherent statistical nuances regarding basket composition and quality adjustments.

## Methodology

The analysis has been developed thanks to the use of the software **RStudio** and **Tableau**. More specifically, for the analysis and data manipulation the main instrument used in RStudio has been the **tidyverse** library, which also includes **ggplot**.

The RStudio code is available for consultation on GitHub ([RStudio code - Key Interest Rates](#)), while the Tableau Scatter Plot Matrix has been published on Tableau Public ([Tableau Public - SPM](#)).

The only adjustment that needed to be done starting from the original datasets was correlated to the fact that from 28/06/2000 up to 14/10/2008 the Main Refinancing Operations Fixed Rate was replaced by its variable alternative. Therefore, the datasets had to be appropriately merged together chronologically to substitute the missing Fixed Rate values with the Variable Rate.

The representations that I've used in this work are:

- **Historical Analysis** of the interest rates cuts and hikes.
- **Scatter Plot Matrix** to better show the correlation among these measures.
- **Historical Analysis** of how the rates react to changes of inflation.

For the most complicated parts of the code I've used Gemini Pro. More specifically, to appropriately represent the hikes and cuts I've followed the AI guidance, although the vast majority of the work even in this aspect is mine.

# About the Key Interest Rates

*« We are the central bank for the euro, and our mandate is to keep prices stable »*

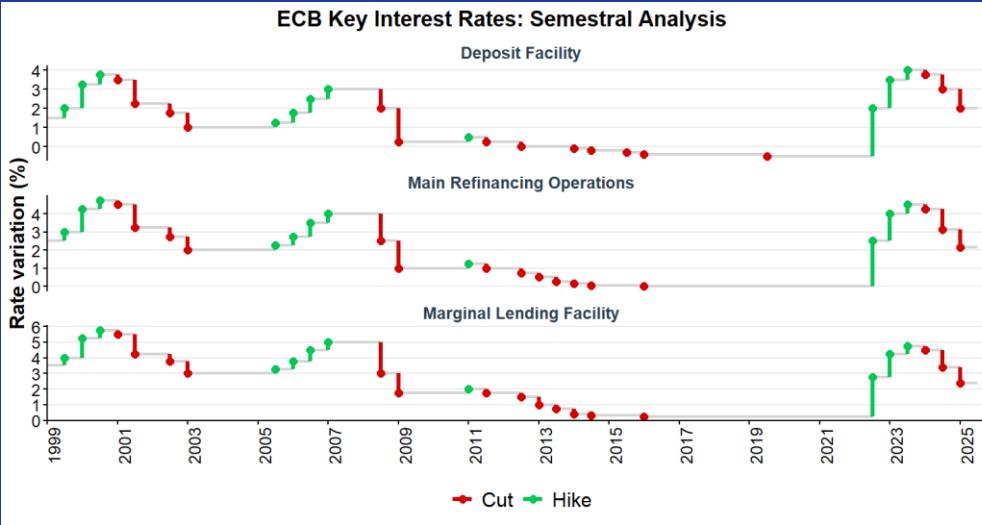
This is one of the most recurring quotes of the European Central Bank when it comes to explaining to citizens and institutions the reasons behind their economic moves. Its main purpose is indeed to maintain prices stable, more specifically to achieve an inflation target of 2% medium term.

Alongside, there are other secondary targets that guide the actions of the European Institution, such as unemployment rate, financial markets stability and economic growth in the Union.

To pursue the motives for which it has been created in the first place, the ECB works on the three Key Interest Rates:

- **Main Refinancing Operations Rate:** it is the interest rate which banks pay when they borrow money from the ECB for one week. From 28/06/2000 to 14/10/2008 the Fixed Rate Tenders Rate was replaced by the variable rate tenders, with the minimum bid rate set at 4.25%. This meant that financial institutions could bid liquidity by specifying both the amount of money they want and the variable interest rate they're willing to pay or receive. This was done to counteract the phenomenon of **overbidding**, in which European banks exaggerated their demand for reserves.
- **Deposit Facility Rate:** it is the interest rate banks receive, or pay in case of negative rates, when they deposit money with the ECB overnight. When media refers to the "era of negative rates in Europe", the referral is to this specific rate.
- **Marginal Lending Facility Rate:** it is the interest rate banks pay when they borrow from the ECB overnight. Constituting an extraordinary operation, it's the highest rate among all.

"ECB Key Interest Rates: Semestral Analysis" by Emily Perillo (© CC BY-NC 4.0).  
Based on ECB Datasets.



#### FIRST INTRODUCTION OF THE EUROPEAN INTEREST RATES (1° SEMESTER 1999 - 1° SEMESTER 2008)

Since their introduction, Key Interest Rates have targeted 2% medium-term inflation, with the **Euro's initial weakness driving hikes** from 1999 to 2000, followed by cuts up to 2003. The high rates observed in this period were once thought to be a historical ceiling, a belief disproven by the levels reached after 2022.

#### THE 2008 CRISIS AND ITS AFTERMATH (2° SEMESTER 2008 - 1° SEMESTER 2014)

To actively assist economic recovery following the **2008 financial crisis**, in the first two semesters the rates were cut by more than 3%, a first in European history. In the following years, despite a minimal hike, there were contained cuts, as Europe rebuilt itself and strengthened its global reputation.

#### THE NEGATIVE INTEREST ERA (1° SEMESTER 2014 - 1° SEMESTER 2022)

A brand new policy introduced **negative values for the Deposit Facility Rate**, while the Main Refinancing Operations stabilized at 0 basis points and the Marginal Lending Facility at 25. Designed to stimulate growth and counteract deflation, these years have proven that the ECB would do **whatever it takes** to guarantee economic stability.

#### POST-PANDEMIC AND MILITARY CONFLICTS (2° SEMESTER 2022 - TODAY)

After the pandemic, prices for energy and food increased due to the Russo-Ukrainian conflict and supply chain issues. In response, a **series of dramatic hikes** were implemented until September 2023, which raised the Main Refinancing Rate by almost 5% in a year. Despite the Gaza War, rate cuts began the following year as inflation perspectives realigned.

## Why do negative interest rates encourage economic circulation?

As previously stated, in the European Union the only interest rate that has ever been negative is the *Deposit Facility Rate*, which is the overnight rate at which the ECB lends to commercial banks. When it is negative, it means that commercial banks have to pay to store their excess reserves, which encourages them to lend out money to the public.

At the same time consumers and companies are attracted by the opportunity of low cost of borrowing, which results in *more investments and general consumption.*

Lower interest rates also increase the demand for domestic goods in foreign markets as the currency is subject to devaluation, thus promoting *exports.*

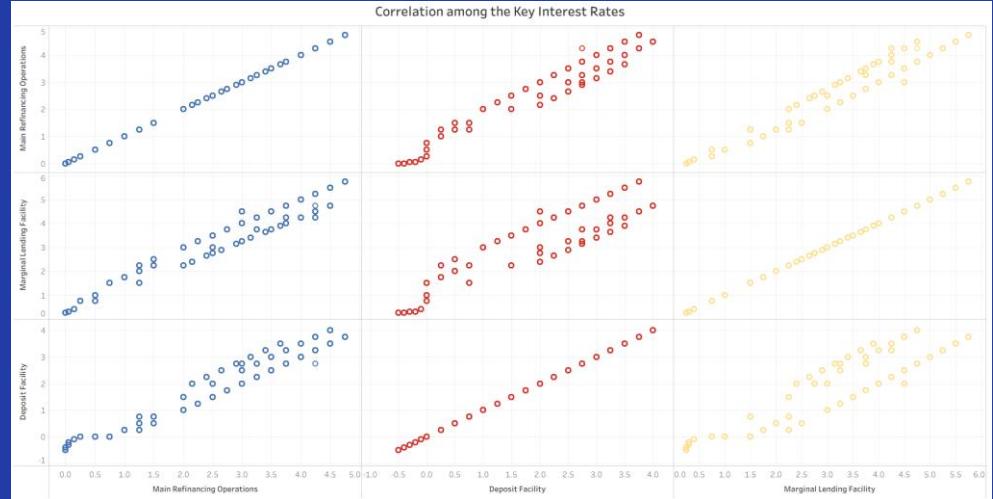
Due to the increase of borrowing and general spending, in addition to higher exports, there is an increase in aggregate demand, which solves the issue of deflation.

Even though negative interest rates have shown to be effective in most cases, their implementation should not be prolonged as it could lead to banks decreasing or even ceasing lending, as it is no longer a profitable financial activity, along with unwanted exchange rate fluctuations.

The Key Interest Rates tend to follow the same trend: when one is subject to a hike, none of the other two are cut and vice versa.

The reason behind it?  
Each of them pursues the same objective: *being the engine of economic prosperity by guaranteeing prices stability.*

If they were not positively correlated, their nature would be distorted and markets would fall into chaos.



"Correlation among the Key Interest Rates"  
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## How do interest rates variations affect inflation?

*Inflation* is the general increase in prices of goods and services in an economy over time, reducing money purchasing power. This means that the same amount of money people and businesses used to invest to buy a certain product or service are no longer enough to complete the same transaction.

Generally speaking, the reason behind it is an increase in demand, which supply cannot satisfy, and therefore there is the need to adjust prices. However, as we've seen in recent years, *shocks* can also constitute a cause of the phenomenon.

What interest rates do to regulate inflation is cooling it down by making borrowing more expensive, thus reducing general demand and encouraging saving. These consequences result in prices decreasing and in the equilibrium between demand and supply being restored.

The opposite but still harming event is *deflation*, which represents a generalized decrease of prices linked to weak demand, recessions, and job losses. The logic of the relationship between interest rates and the latter described is overall the same but mirrored, as in this case what central banks do is decrease rates to encourage investments and overall demand.

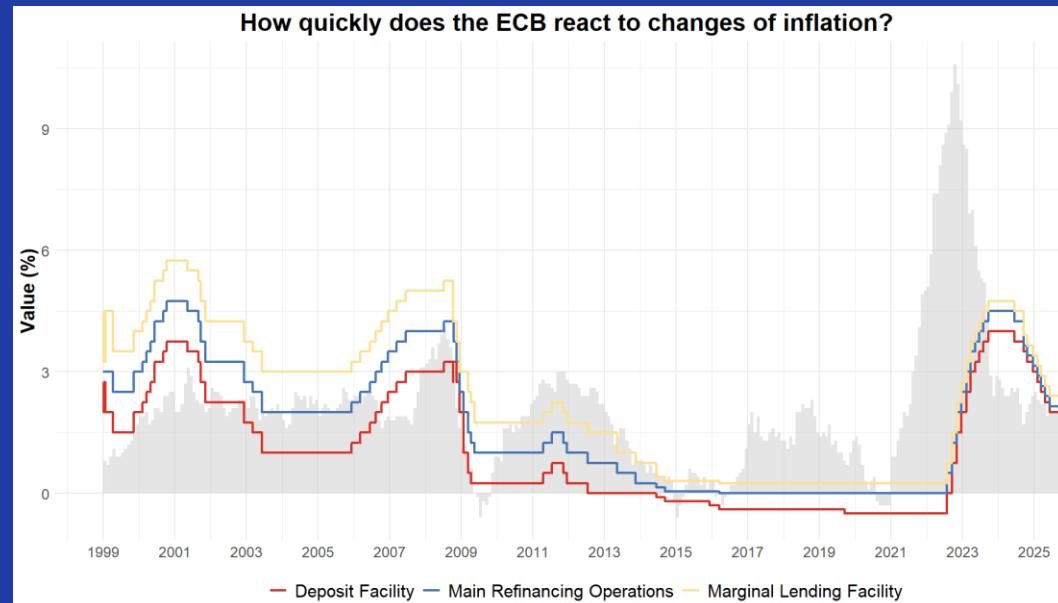
Despite inflation being the main driver of monetary policy, its variations do not immediately result in a change of the Key Interest Rates.

Since the target is a 2% medium-term inflation, the ECB first investigates the underlying causes, often corresponding to **shocks**, defined as unexpected or unpredictable events that affect economic variables, such as prices.

The **energy shock** following the Russo-Ukrainian War serves as the most important and contemporary example. As a matter of fact, the ECB initially delayed its intervention because monetary policy typically affects the economy with a **delay of 12 to 18 months**, making reactions to temporary shocks counterproductive.

However, as perspective changed and the risk of the so-called **de-anchoring of inflation expectations** surfaced, continuous hikes became necessary to restore the institution's credibility and ensure stability.

While this hesitation highlights how being cautious can sometimes lead to **more aggressive moves** later, the maneuver has been proven effective in bringing inflation back to its desirable target.



*"How quickly does the ECB react to changes of inflation?"* by Emily Perillo (© CC BY-NC 4.0).  
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