EUROPEAN CENTRAL BANK
EUROSYSTEM

AI applications and governance at the ECB

Online workshop “AI in Central Banking”
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Disclaimer: Views expressed are those of the presenter and do not necessarily reflect those of the ECB.

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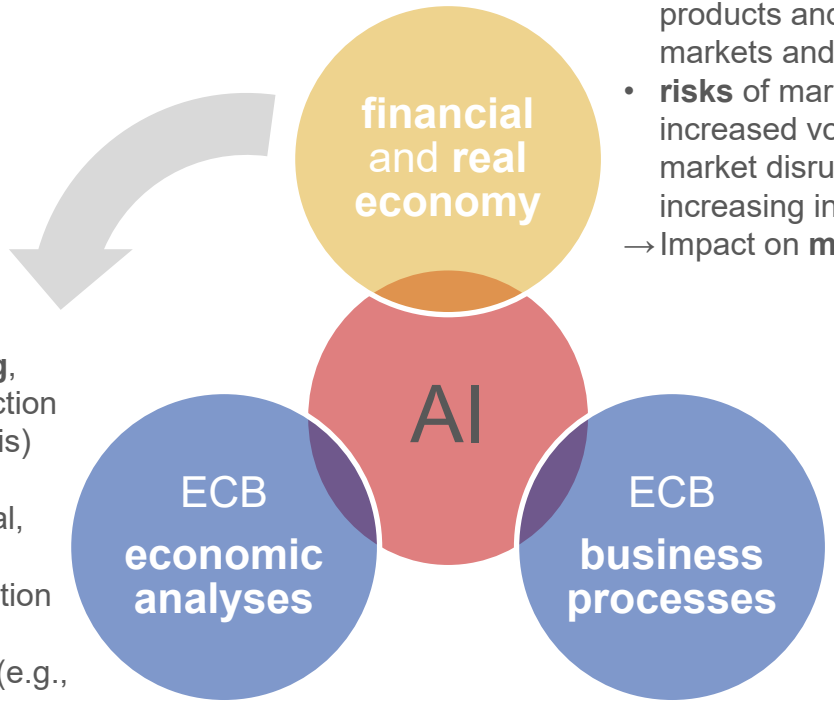
AI at the European Central Bank

- **opportunities** for new products and services, markets and industries
- **risks** of market concentration, increased volatility, labour market disruptions and increasing inequality

→ Impact on **monetary policy**



- macroeconomic **forecasting**, nowcasting and event prediction (e.g., economic or fiscal crisis)
- creating and evaluating **alternative data** (incl. textual, satellite image, videos)
- macro **modelling** (e.g., solution methods for macro models).
- new tools in **econometrics** (e.g., causal tree techniques)

- **information access** (e.g., chatbot with access to information repository)
- **data management** (e.g. data cleaning or chart preparation)
- **briefing and meeting process** (e.g. briefing preparation, meeting summaries)
- **Eurosystem collaboration** (e.g. written procedures and reports)

Overview

1. AI implications for the economy
2. AI applications for economic analysis
3. AI applications for business processes
4. AI strategies and governance at the ECB

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AI implications for the economy

- Generally, **positive impact of AI on economy expected**
  - Positive impact on **employment** (Albanesi et al. 2023) and **productivity** (Baily et al. 2023)
  - Possible **disinflationary** effects (Csonto et al. 2019, Consolo 2021)
  - No negative consequence of AI on **financial stability** yet, but a growing concern (de Cos 2024)
- However, **high uncertainty** of the impact of AI when more widely adopted
  - General-purpose AI raise uncertainty about the channels through which labour markets and price stability may be affected
- **ECB will continuously and carefully analyse impact** on the medium-term economic outlook and the transmission of monetary policy, also considering financial stability concerns

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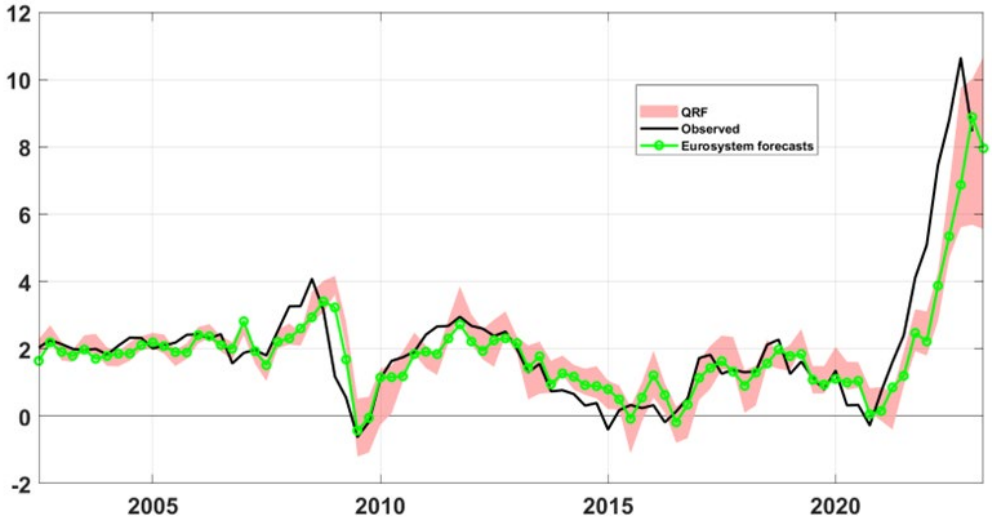
AI applications for economic analysis: identifying non-linearities

- Use machine learning to identify **non-linearities in macro forecasting**
- Example: Quantile Regression Forest models for **non-linear forecasts** (Lenza, Moutachaker and Paredes 2023)
- Models do not (yet) systematically **outperform** the Eurosystem forecast or Survey of Professional Forecasters

Headline inflation and forecasts

(percentage)



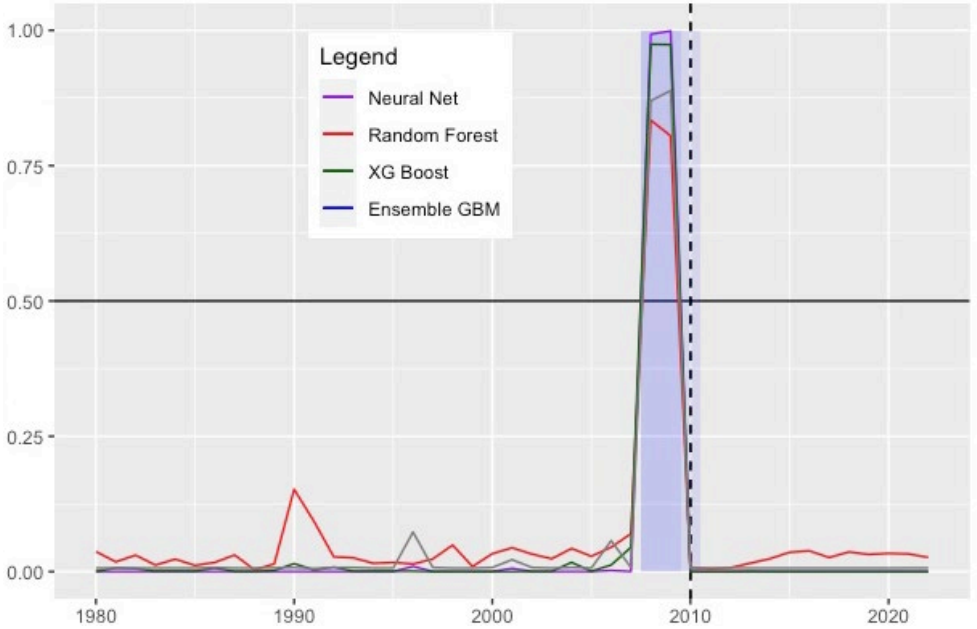
Source: Lenza, Moutachaker and Paredes (2023).
Notes: Black solid line: year-on-year growth rate of the HICP (headline inflation); red area: 16th to 84th quantiles of the density forecasts from the non-linear model (QRF), with a horizon of six months ahead, for the year-on-year growth rate of the HICP; green line with circles: Eurosystem inflation projections, with a horizon of six months ahead, for the year-on-year growth rate of the HICP.

AI applications for economic analysis: event prediction

- Use large data and machine learning for **event prediction** (e.g., economic or fiscal crisis)
- Example: 36 million observations of macro and fiscal, financial and political data used to **predict fiscal crises**
- Machine learning models **outperform** standard logit/probit regression models (Hellwig 2021)

Predicted probability of fiscal crisis in Greece

(probability one and two year ahead)

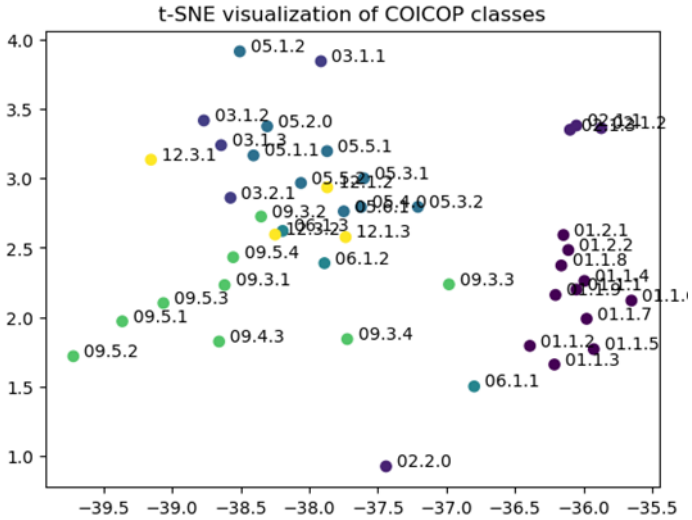


Source: Bischl, Freier & O'Doherty (forthcoming).
Notes: LHS - binary fiscal crisis indicator following Medas et al. (2018); RHS - dataset of around 6000 macro and fiscal, financial and political annual variables covering 188 countries from1980 to 2015; training set is 1980-1999, testing set is 2000-2013

AI applications for economic analysis: inflation nowcasting

- Use LLMs to improve **inflation nowcasting**
- Example: **Daily Price Dataset (DPD)** - classification of 38 million individual products to COICOP with the FastText algorithm (Facebook 2015) to separate inflation components for classification of individual products
- **Collaboration with BIS-Eurosystem Innovation Centre** for use of LLM (GPT 4) for classification

COICOP classes visualization



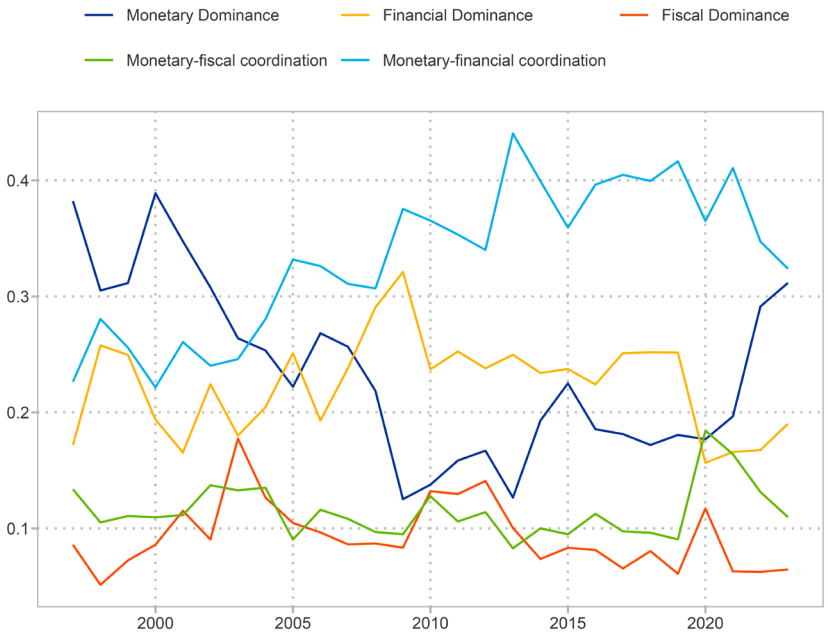
Source: DPD classification pipeline, cf. also Osbat (2022).
Note: Similar COICOP classes have a semantically similar description, and therefore a similar vector representation. For instance, food COICOP classes (01.x.x) are clustered together.

AI applications for economic analysis: textual analysis

- Use document repositories and large language models (LLMs) for **analyses of central bank communication**
- Example: Using **GPT algorithm**, analysis of rhetoric on policy linkages in 18.000 central banker speeches

Policy interaction in central bank speeches

(percentage of sentences in a given year)



Source: Bischl, Freier & Leek (2024). Beyond Monetary Separation: A Textual Measure of Central Bank Policy Interactions Using ChatGPT.
Notes: two million sentences taken from 20.000 central bank speeches in the BIS database; analyse of sentence in context; all includes all normative sentences concerning monetary, fiscal or financial policy

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AI in business processes

- High **administrative burden at ECB**
  - Federal nature of the Eurosystem requires close coordination with national central banks
  - ECB's membership in EU council and committees
- **AI applications** being tested to perform recurring or menial tasks
  - Information access (e.g., chatbot with access to information repository)
  - Data management (e.g. data cleaning or chart preparation)
  - Briefing and meeting process (e.g. briefing preparation, meeting summaries)
  - Eurosystem collaboration (e.g. written procedures and reports)
  - Surveys (summarising telephone interviews)

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Weighing opportunities, costs and risks

- **Vast gains in terms of analytical leverage**, e.g., advances in heterogenous agent modelling or improved economic forecasting
- **Resource savings**, e.g., automated administrative processes and data-related tasks

- **Transition and implementation costs**, given limited staff resources which may be particularly high for early-adopters (e.g., because of high set-up costs)
- **Operational risks** of AI applications, e.g., to system bugs or data breach
- but also **risk of falling behind**, giving rise to policy choice and reputational risks and a challenging catch-up

The AI strategy for Directorate General Economics

Step 1
Develop AI knowledge base

- seminar series
- training courses
- regular visiting researchers
- target recruitment

Step 2
Strengthen collaboration

- strengthen existing collaboration
- identify best practices,
- harness third-party expertise on algorithms and data, IT infrastructure

Step 3
Try out AI applications

- encourage experimentation with applications for economic analysis
- explore technologies to facilitate administrative processes

Step 4
Identify priority areas

- identify priority areas, covering both economic analysis and processes
- update priority list on an annual basis

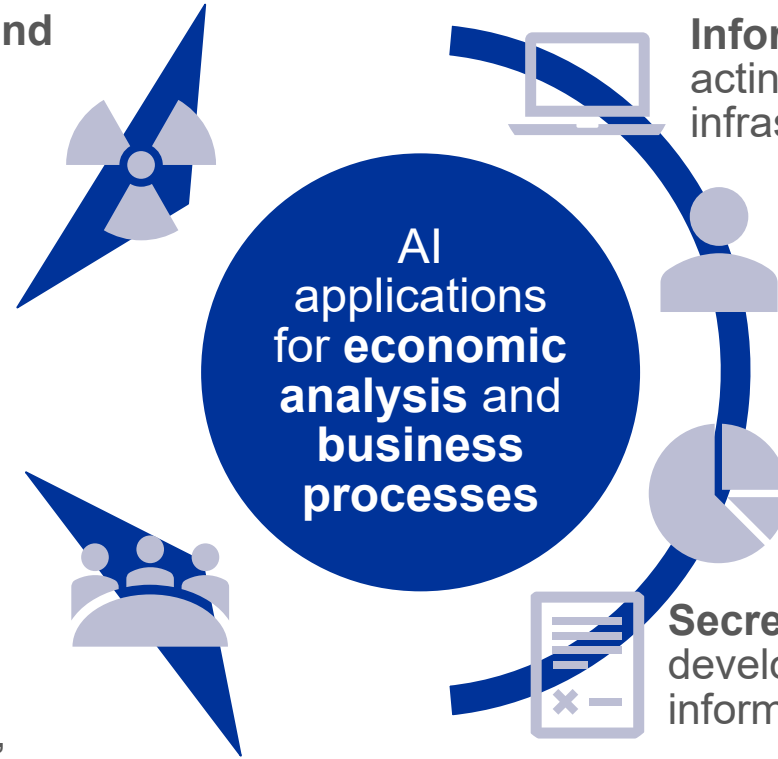
AI governance at the ECB

Risk assessment and mitigation

- Operational Risk Committee
- Data Office
- Data Protection Officer

Collaboration

- Single Supervisory Mechanism
- Eurosystem central banks
- Federal Reserve, Bank of England, BIS



Information Systems
acting as hub for AI agenda, IT infrastructure and expertise

Human Resources
identify and address knowledge gaps

Statistics
developing and maintaining access to data

Secretariat
developing tools to access information and archives

Main messages

1. The **broader macro-financial implications** of a wider AI revolution remain difficult to foresee.
2. In central banks, AI is expected to have a **vast leverage effect in terms of economic, financial and monetary analysis**.
3. In addition, AI could allow for significant **resource savings** from automated business processes and data-related tasks.
4. At the ECB, opportunities of using AI are carefully assessed, **weighing benefits against costs and risks**.

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