COOPERATION AND RESOURCE SHARING IN MACRO MODELLING: RATIONALE, MECHANISMS, AND POSSIBLE WAYS FORWARD

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OUTLINE

1. Why is cooperation and resource sharing important for modelling at central banks?

2. Mechanisms for effective resource sharing and examples of successful modelling cooperation

3. Future avenues for cooperation and resource sharing

WHY IS COOPERATION AND RESOURCE SHARING IMPORTANT FOR MODELLING AT CENTRAL BANKS?

- **Efficiency**: pooling resources maximizes the output for all institutions involved

- **Harmonisation** of modelling approaches and of simulation exercises

- **Differences in resource availability**: larger central banks have more analytical resources than smaller ones

- **Data pooling**: Models are disciplined by data, and increasingly so by *micro* data.
  - Data pooling by national central banks (NCBs) allows Eurosystem researchers to have *EA-wide* micro datasets.

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- Play a major role in ensuring sustained modelling cooperation…

  - … and some (necessary) harmonization of modelling tools and model-based exercises

- Notable examples in the Eurosystem:

  - **Working Group Econometric Modelling (WGEM)**: main Eurosystem forum for model-based collaboration, model co-development, code sharing, etc.

  - **Working Group Public Finance (WGPF)**: ensures harmonization e.g. of public debt sustainability analysis (DSA)

  - **Working Group Forecasting (WGF)**: promotes cooperation focused on macro projections

- Shared (ECB & NCB) governance of some of these groups has proved useful in increasing their value for the Eurosystem as a whole
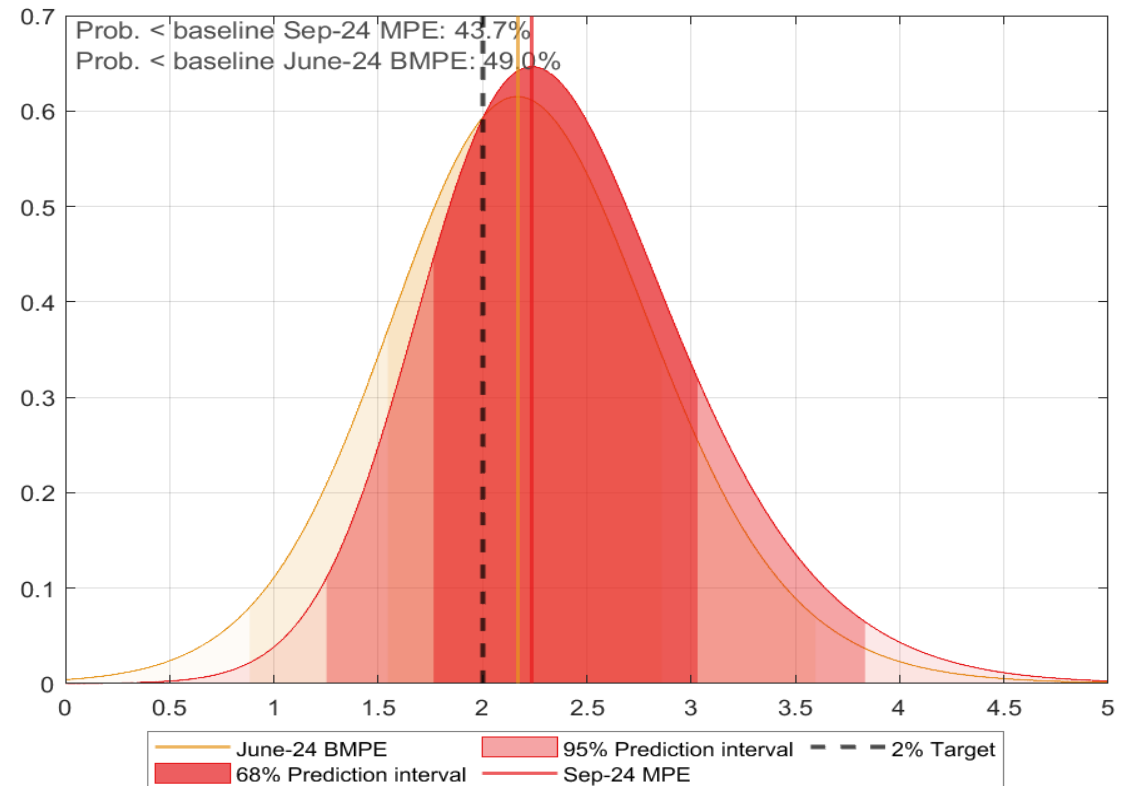
- A Joint WGEM-WGF expert group studied EA inflation- and GDP-at-Risk from both a structural and time series/forecasting modelling perspective. A toolkit was created and shared across the Eurosystem.

Balance of risk to the GDP growth projections
(growth-at-risk) Model disagreement

Probability distributions of 2025 HICP inflation projections based on inflation-at-risk models
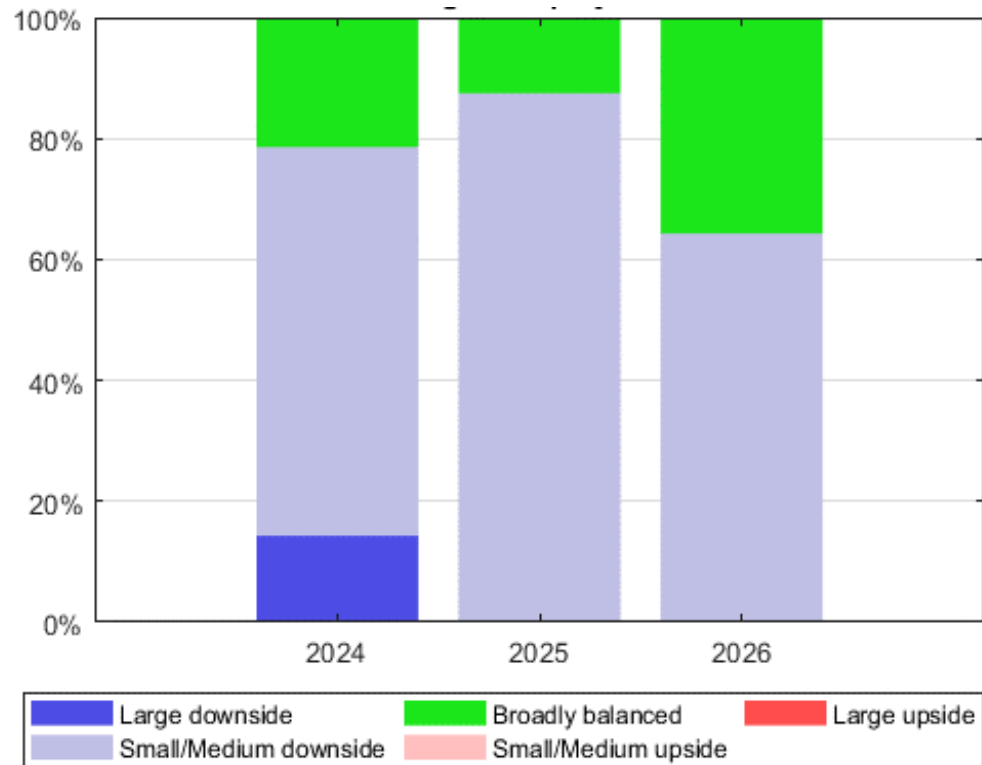
Sources: ECB staff calculations. Note: This figure represents the balance of risk to the September 2024 MPE baseline as assessed by best performing growth-at-risk models. Following the QRA taxonomy, balanced risk stems for a probability of "an outcome being below the baseline" between [47,5% and 52.5%]. Large downside (upside) for a probability higher (lower) than 37.5%; Small/Medium stands for a probability between these thresholds.

Sources: ECB staff calculations. Notes: The chart depicts the predictive distributions of headline HICP inflation for the year 2025 from a combination of best-performing inflation-at-risk models. The combined density follows the quantile aggregation approach weighting the individual densities based on their corresponding (inverse of) average continuous ranked probability score. All distributions are assumed to follow skew-t distributions whose modes are tilted towards the September 2024 baseline projections
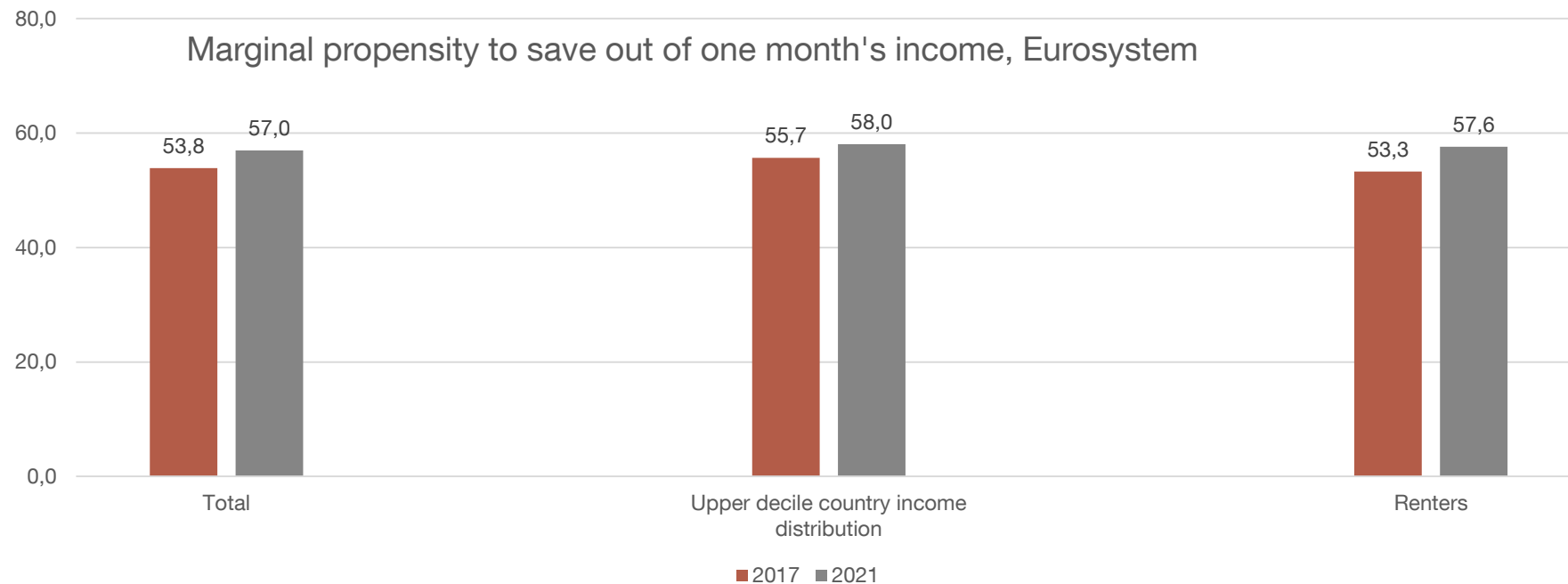
- Typically focused on particular topics

- Often data-oriented (allowing for data pooling)

- Some prominent examples:

  - Household Finance and Consumption Network (**HFCN**): household-level wealth, debt and income data

  - Price-setting Microdata Analysis (**PRISMA**) Network: micro price data

  - Challenges for Monetary Policy Transmission (**ChaMP**) Network (see appendix)

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- Collects and studies NCB-provided micro price data, including the data underlying the CPI and PPI

- The rise of inflation in 2021-2022 was marked by a notable increase in the **frequency of price increases**

  - Critical input in the calibration of EA-wide state-dependent pricing models

MONTHLY FREQUENCY OF PRICE CHANGES IN SPAIN (%)
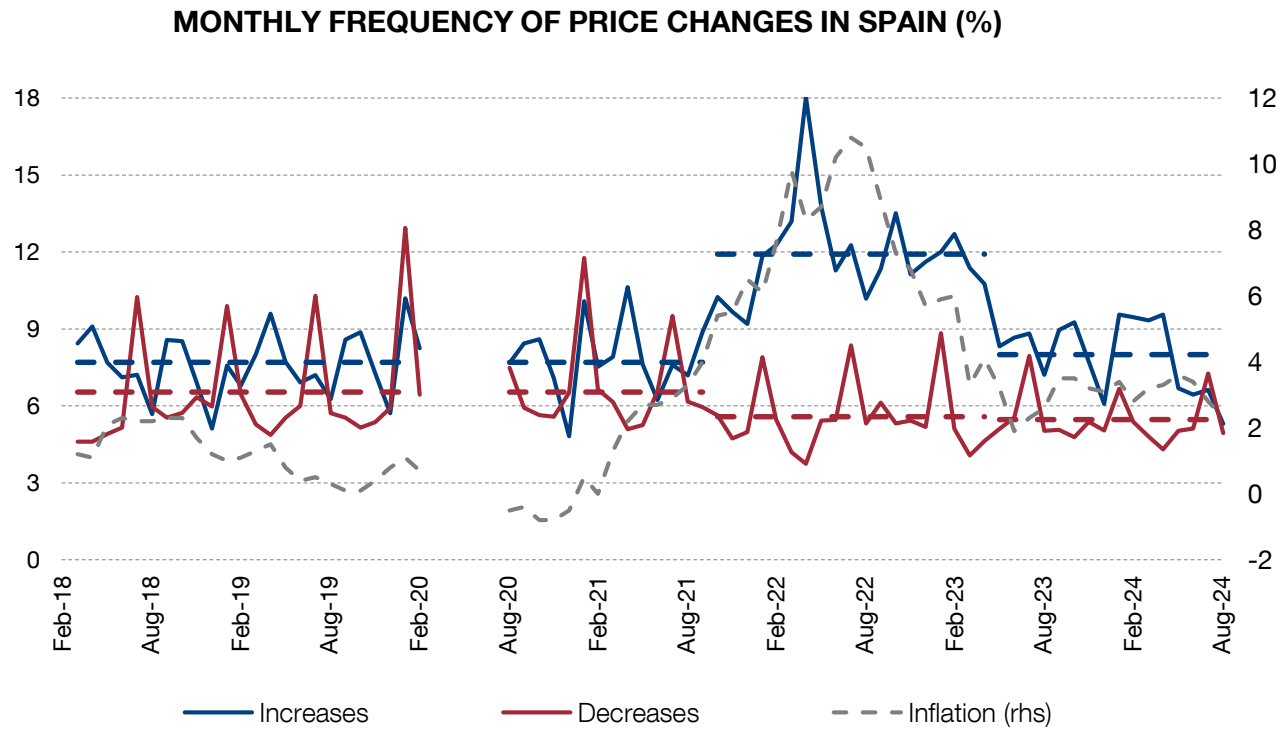
Sources: Banco de España and INE. The broken horizontal lines show the average increases and decreases for specific sub-periods.

- Conducts the Eurosystem's Household Finance and Consumption Survey (HFCS), in which NCBs collect household-level data on household finances and consumption

- Marginal propensities to consume (MPC) out of income have *declined* since 2017

  - Critical input in the calibration of EA-wide New Keynesian heterogeneous agents (HANK) models

Marginal propensity to save out of one month's income, Eurosystem

	Total	Upper decile country income distribution	Renters
2017	53,8	55,7	53,3
2021	57,0	58,0	57,6

■ 2017 ■ 2021

Source: HFCS, waves 3 and 4. Based on the question: "Imagine you unexpectedly receive money from a lottery, equal to the amount of income your household receives in a month. What percent would you spend over the next 12 months on goods and services, as opposed to any amount you would save for later or use to repay loans?" The graph shows 100 minus the answer.

- Beyond formal structures, **informal** cooperation can also be very fruitful

- Example: **Costain, Galo and Thomas (2024)**; forthcoming in *Journal of Finance*
    - Extension of Vayanos-Vila (2022) yield curve model to two-country monetary union with default risk
    - Authors shared code with ECB (and one NCB). Model used in ECB staff analyses of the effects of asset purchases

- Useful for understanding **transmission channels** of sovereign bond purchases in the EA…
  - *Credit risk extraction* more important than duration extraction for PEPP's impact on peripheral yields
- … and simulating **policy counterfactuals**
  - PEPP's *flexible* design boosted its effectiveness compared to a rigid APP-style counterfactual
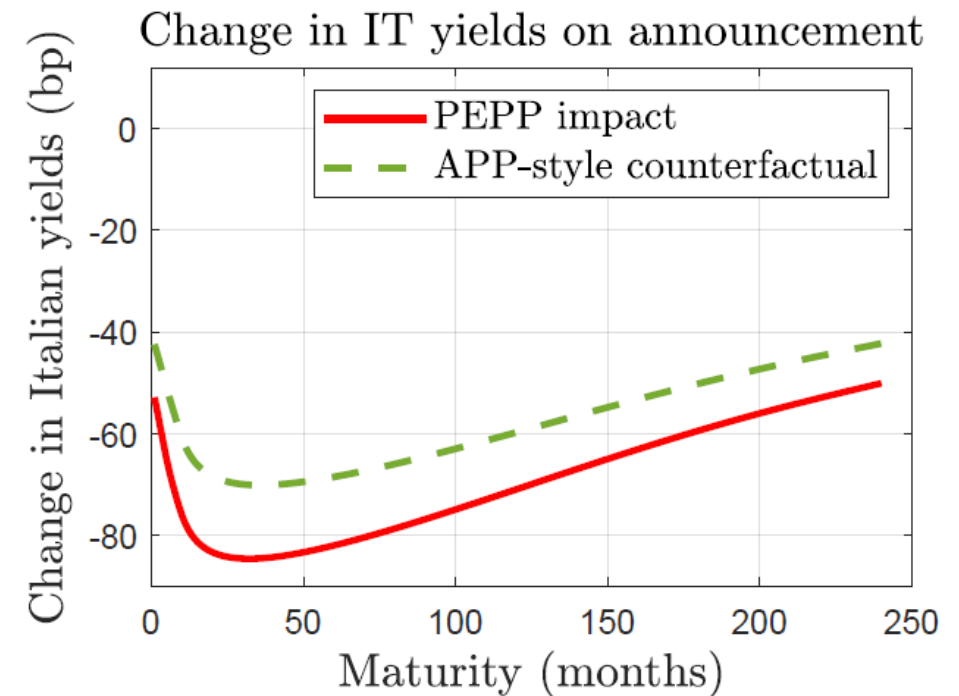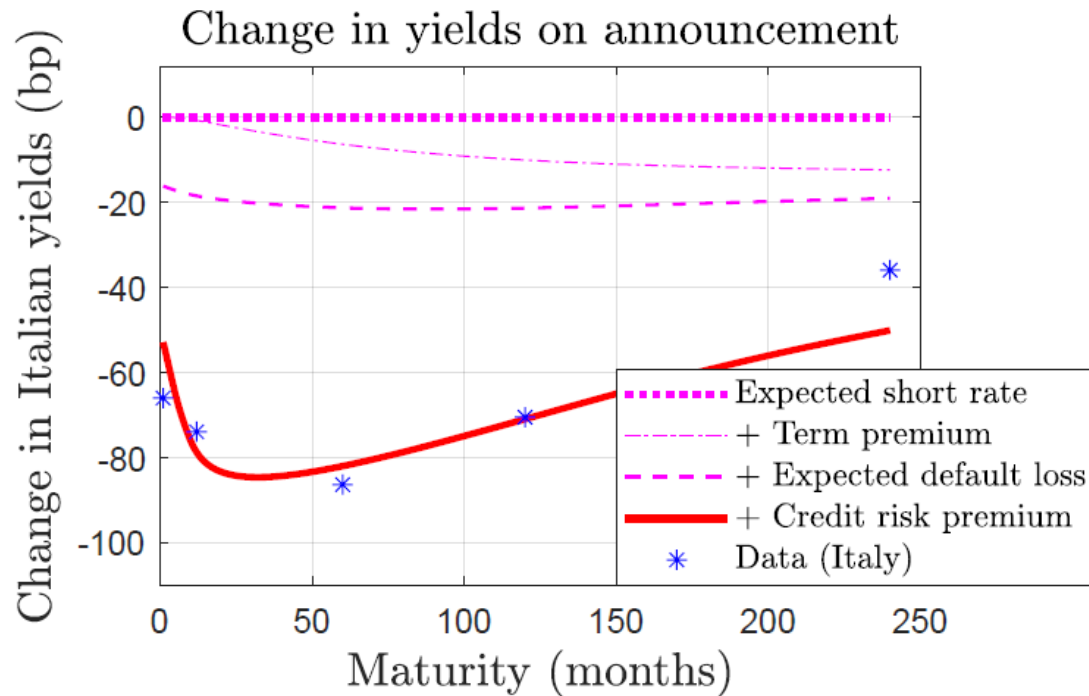
SOURCE: Costain, Nuño and Thomas (2024), "The term structure of interest rates in a heterogeneous monetary union"

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3. **Future avenues for cooperation and resource sharing**

- Promote further model-based cooperation and code sharing
  - e.g. by developing platforms for sharing model codes and/or model outputs
  - or by issuing "calls for models" addressed at specific policy-related needs

- Coordinating and centralizing NCBs' micro data labs
  - to allow all NCBs to access other NCBs' micro datasets

- Foster collaboration between Eurosystem and other central banks
 - Following the example of the NGFS Modelling group

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THANK YOU FOR YOUR ATTENTION

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BACKGROUND SLIDES

- Extends the Euro Area and Global Economy model (Gomes et al., 2012) to include green and brown energy sectors, analyzing the macroeconomic effects of the **green transition** in the Euro Area

- Carbon taxes act as a cost-push shock, increasing inflation and reducing output

- Subsidies to green energy firms and financially constrained households mitigate the recessionary effects
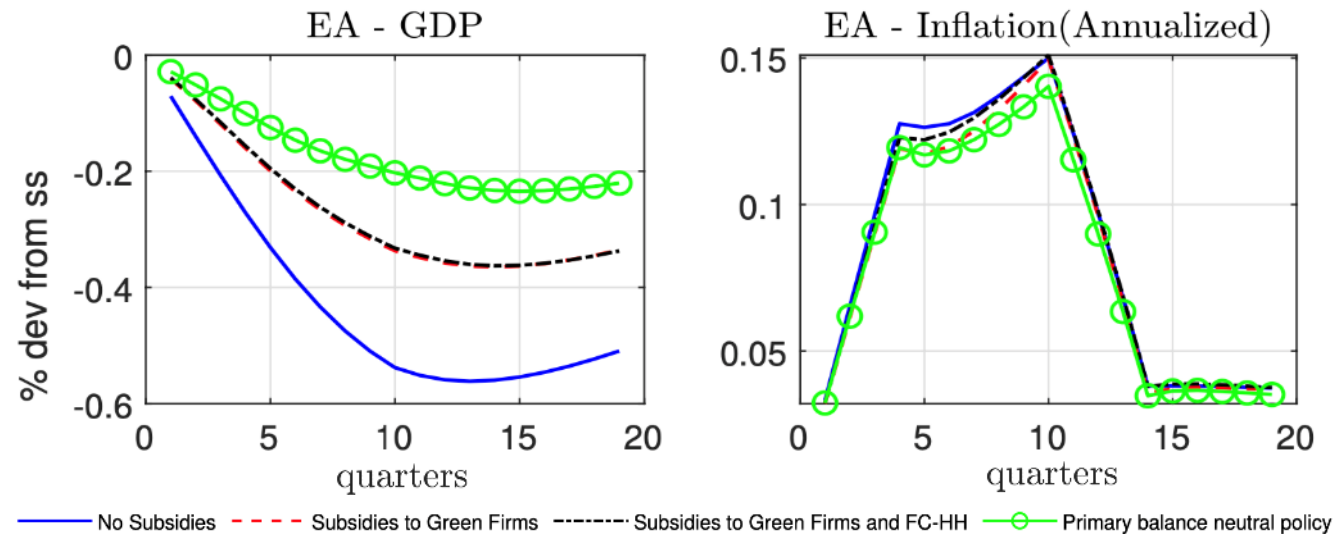
Notes: Red-dashed lines: subsidies to green energy firms (33%; remaining 66% kept by the government). Black-dashed-dotted lines: subsidies to green energy firms and financially constrained households (33% each; remaining 33% kept by the government). Green-circled lines: subsidies to green energy firms and financially constrained households under a primary balance neutral policy (50% each, i.e., the government redistributes the entire carbon tax revenues).

Source: García-Sánchez, Jacquinot, Lenarcic, Mavromatis, Papadopoulou and Silgado-Gómez (2024), "Green Transition in the Euro Area: Domestic and Global Factors"
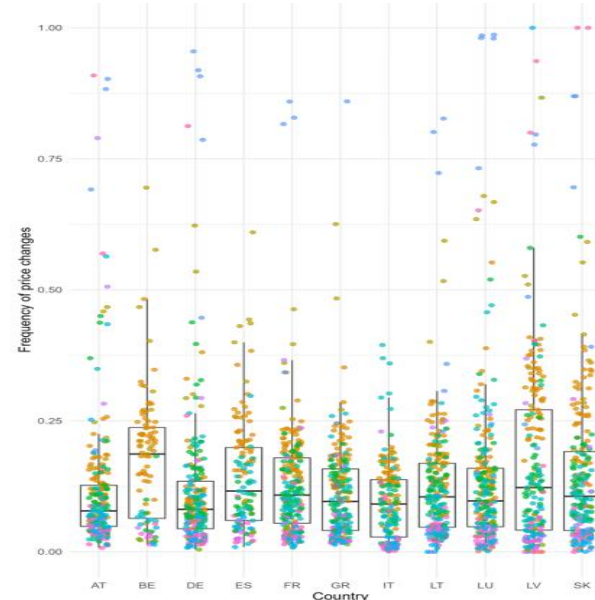
- **Dynamic multi-country input-output model that captures cross- and within-country heterogeneity to analyze shock transmission at the EA level and across countries:**

  - Joint research effort of several NCBs with Elisa Rubbo: ECB, BdE, BdI, BoF, NBB, LVB, OeNB

  - Data collection for all EA countries on input-output linkages, country-industry characteristics, price and wage rigidity data across industries and countries, wealth shares and skills of households within each country, etc.

  - Benchmark against pool of DSGE models already stablished in the Eurosystem (in progress)

**Panel A: Country-Industry Labour Shares**

Notes: Labour share in across industries and countries. Each dot represent the labor share in value added in country-industry pair.

Panel B: Country-Good Price Frequency Ajustment

Notes: Price frequency adjustments of goods in different countries, shared by the Price-setting Microdata Analysis Network (PRISMA) of the ECB.

Panel C: Country-Industry Empirical Responses of Hours to a Monetary Policy Shock
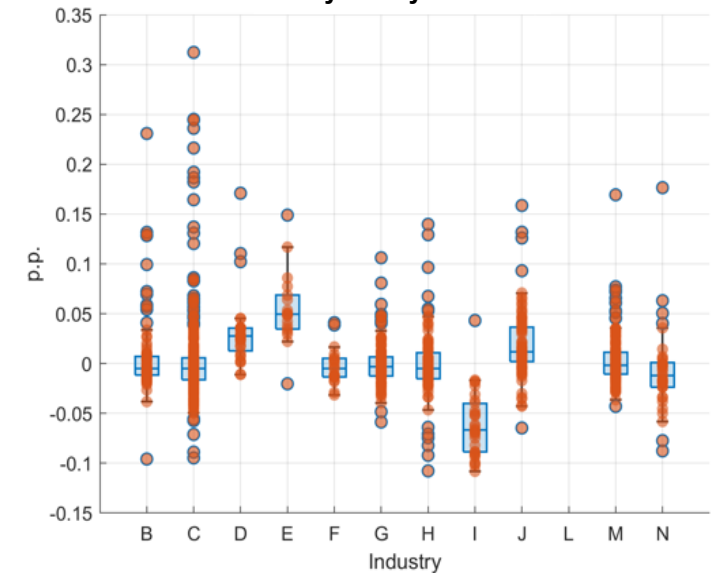
Notes: Empirical responses to a Euro Area positive monetary policy shock (Jarociński and Karadi, 2020). Each dot corresponds to the peak cumulative response of hours for each country-industry pair relative to the average response.