The term structure of interest rates in a heterogeneous monetary union

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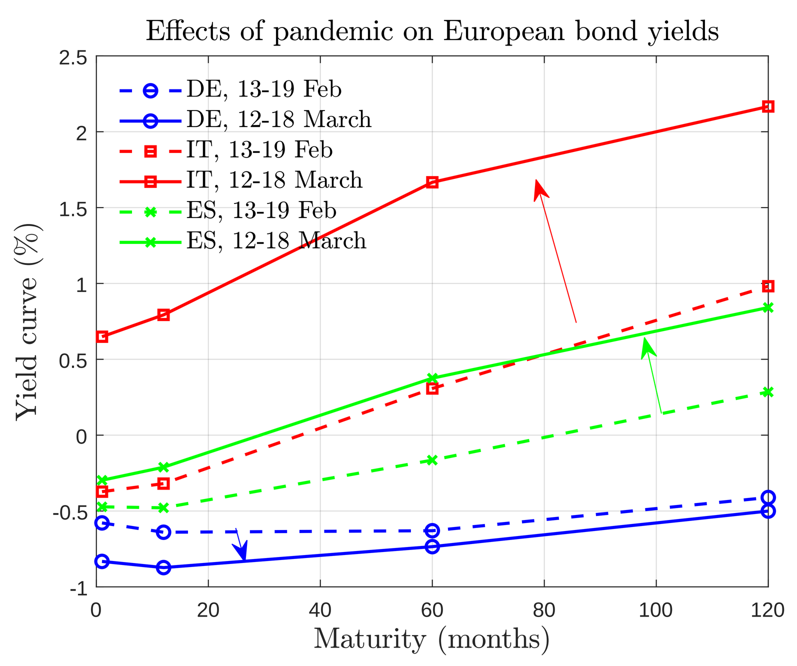
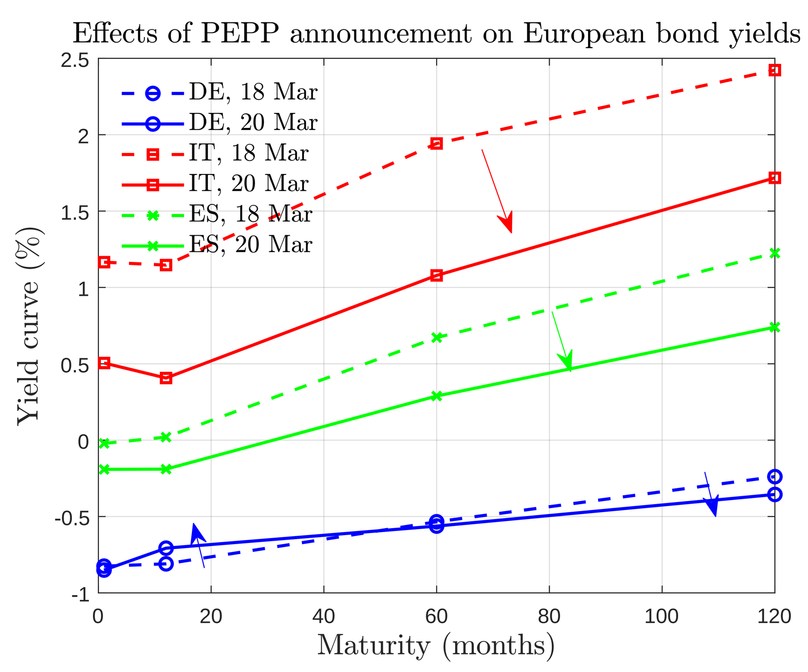
Motivation

What explains euro area yield curve movements during the Covid pandemic?



Peripheral yields rose Feb. – Mar. 2020 as pandemic spread



Peripheral yields fell in Mar. 2020 when PEPP was announced

- **"Duration risk extraction" cannot explain parallel shifts** in peripheral yields observed during **pandemic outbreak** and upon **PEPP announcement**
- Can variation in **peripheral default probability** explain these shifts?

This paper

We build a microfounded term structure model for a monetary union with heterogeneous default risk.

- **Vayanos/Vila (2021)** built an **arbitrage-based yield curve model** with an affine solution to analyze the effects of **asset purchase policies**.
- We generalize VV21 to model a **two-country monetary union** with heterogeneous **default risk**
  - Core debt: default free
  - **Peripheral debt: defaultable**
- **Extension: endogenous default risk**
  - Rollover crisis may hit Peripheral debt
  - If so, Peripheral government chooses whether to default
  - **Asset purchases decrease fiscal pressure** faced by the Peripheral government, reducing its default incentives
- We calibrate the extended model to **analyze the PEPP announcement** and compare counterfactuals.

Affine yield curves in a monetary union

Affine term structure still obtains with time-varying but deterministic **default risk** ψ_t:

$$y_t(\tau) = \frac{1}{\tau}\left(A_t(\tau) r_t + C_t(\tau)\right)$$

- **Decomposing Peripheral yields**:

$$y_t(\tau) = \underbrace{y_t^{EX}(\tau)}_{\text{expected rates}} + \underbrace{y_t^{TP}(\tau)}_{\text{term premium}} + \underbrace{y_t^{DL}(\tau)}_{\text{expected default loss}} + \underbrace{y_t^{CR}(\tau)}_{\text{credit risk premium}}$$

- **Decomposing Core yields**:

$$y_t^*(\tau) = y_t^{EX}(\tau) + y_t^{TP*}(\tau),$$

where $y_t^{TP*}(\tau) \to y_t^{TP}(\tau)$ as Peripheral default risk approaches zero.

- **A permanent change in default risk** causes a **parallel shift** in Peripheral yields:

$$y_t(\tau) = (\psi\delta + \bar{\xi}) + \frac{A(\tau)}{\tau} r_t + \tilde{c}(\tau).$$

Extended model

Endogenizing the default probability ψ_t:

- Suppose **rollover crisis** arrives at rate η and ends at rate ϕ.
- To **avoid default**, government must self-finance its deficit d_t and maturing debt $f_t(0)$ during the crisis.
- Hence **fiscal pressure** on the government is

$$F_t \equiv E_t \int_{s=0}^{\infty} e^{-(\hat{r}+\phi)s}\left(d_{t+s} + f_{t+s}(0) - f_{t+s}^{CB}(0)\right) ds$$

  if the central bank remits proceeds $f_t^{CB}(0)$ from its maturing bond portfolio back to the government.
- So if default costs x, with distribution Φ, the **default probability** is:

$$\psi_t = \eta \Phi(F_t).$$

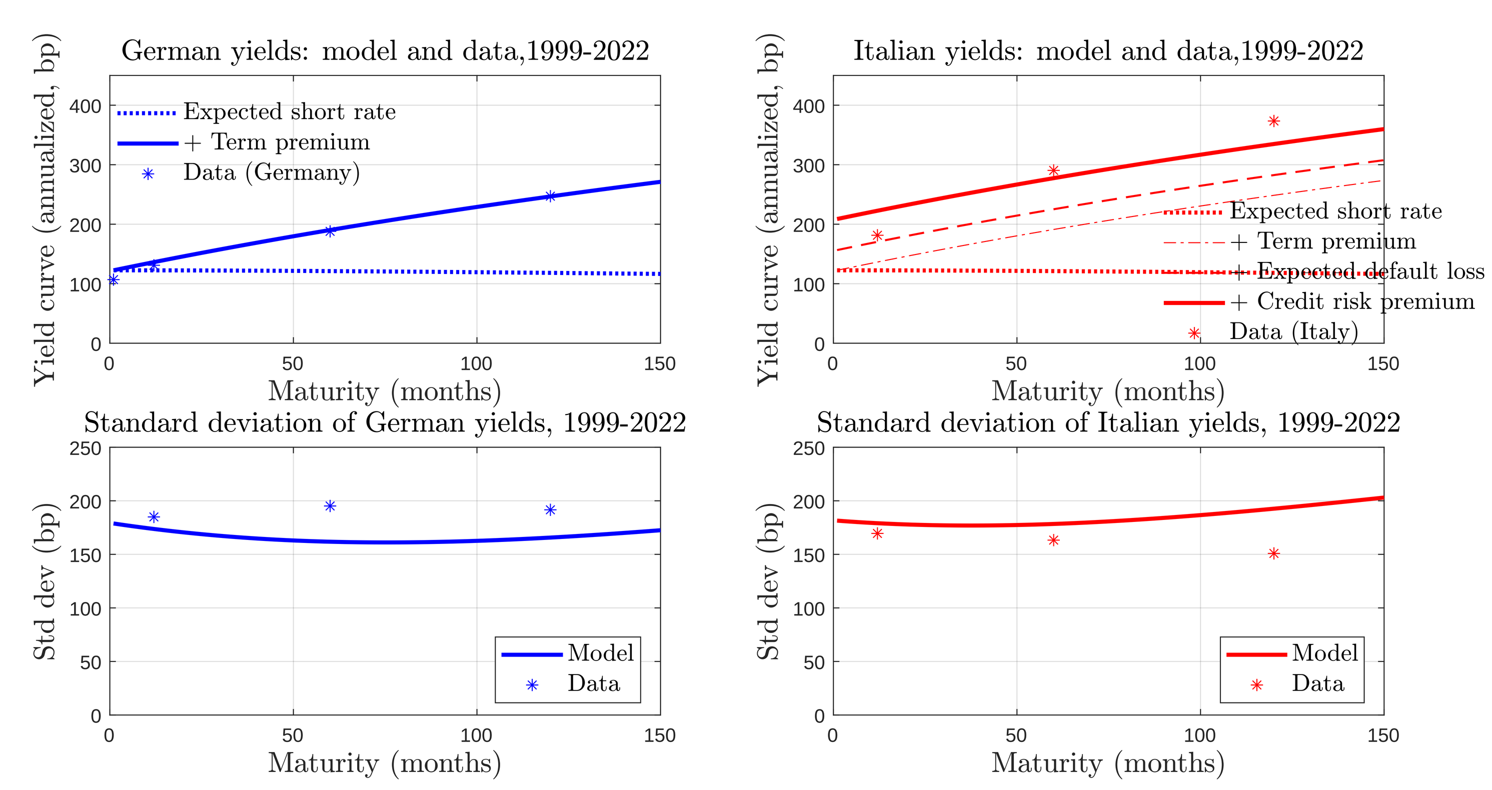
Three-factor calibration*

First moments and PEPP effects	
Risk aversion	Match long-run DE term premium
Intercept of default probability	Long-run IT sovereign spread
Slope of default probability	Shift in IT yields when PEPP announced
Higher moments	
Std. dev. and autocorrelation of PH shocks	Match long-run std. dev. of yields
Correlation of PH shocks between DE and IT	Sample correlation of DE and IT yields
Slope of PH demand function	Correlation between long and short yields
Discount rate in fiscal pressure aggregate	Effect of PEPP on long vs. short yields

*Factors include riskless rate and two preferred-habitat demand shocks: $q_t = (r_t, \epsilon_t^h, \epsilon_t^{h*})$.

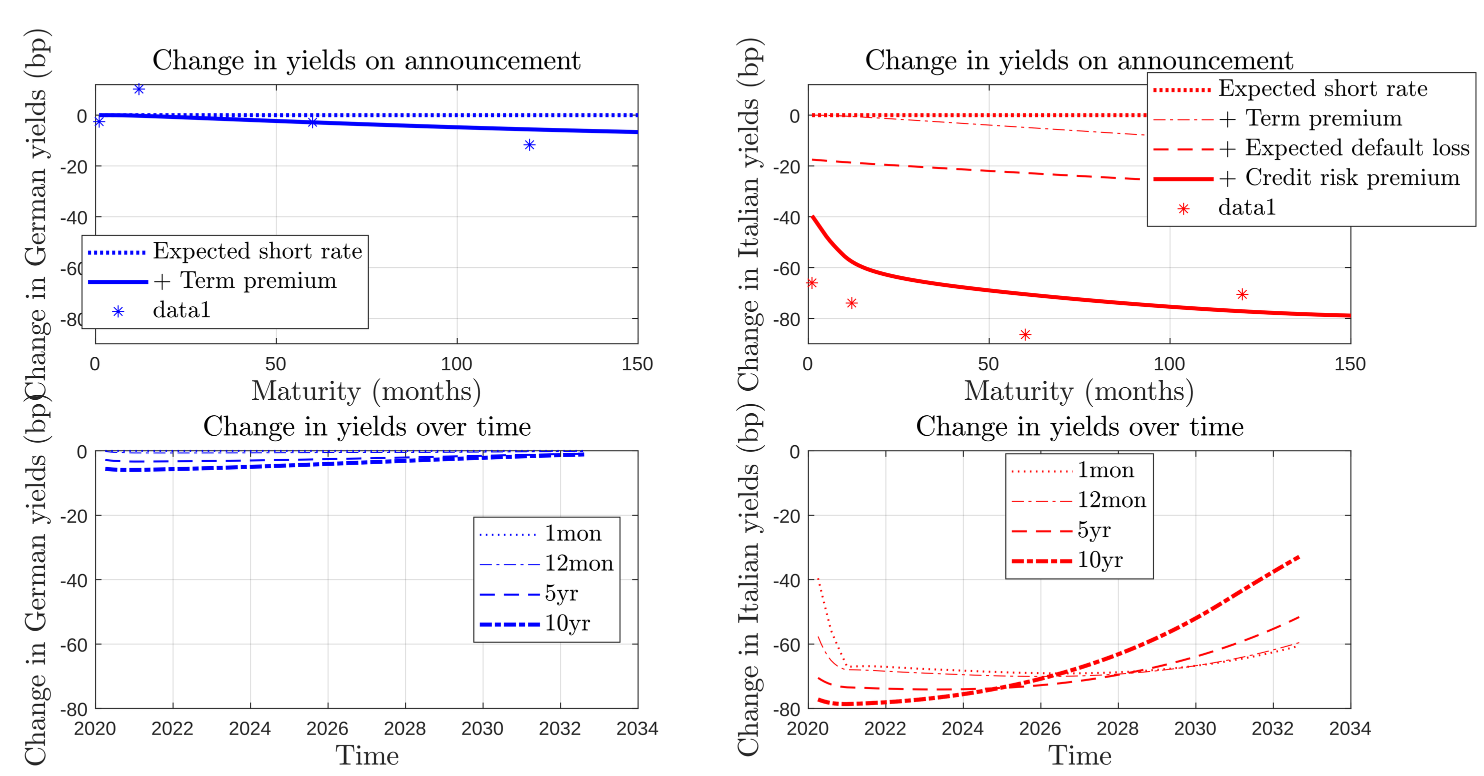
Quantitative results

First and second moments of yields: Model vs. data (DE and IT, 1999-2022)



- **Decomposition**:
  IT yields ≈ DE yields + expected default loss + credit risk premium

Impact of PEPP announcement: Model vs. data (DE and IT, 18-20 March, 2020)



- "Duration risk extraction" was quantitatively unimportant
- **"Default risk extraction"** explained most of the impact of PEPP
  - PEPP reduced fiscal pressure, and hence **default probability** too
  - PEPP reduced price of risk, and hence **credit risk premium** too
- Therefore, PEPP's **flexible design** enhanced its impact (12bp more)