A Multi-Country Model of Inflation-Indexed Debt with an Application to the Euro Area

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Abstract

We introduce a multi-country model of inflation-indexed bond prices that accounts for country-specific bond-specific risk premia. Using data from France, Germany, Italy, and Spain, we find large and time-varying bond-specific risk premia in all four countries. After adjustment for bond-specific risk and general term premia, we obtain an estimate of the risk-free real rate representative of the euro area and a related estimate of the natural rate of interest. Combining the two provides an estimate of the stance of monetary policy common to the euro area.

JEL Classification: E43, E47, E58, F42, G12, G13, G15

Keywords: term structure modeling, financial market frictions, liquidity premium, convenience premium, safety premium, rstar, European Central Bank

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1 Introduction

In this paper, we focus on settings with multiple bond markets, each plagued by market-specific liquidity or convenience premia, while sharing a common frictionless risk-free curve. One obvious example would be markets for corporate bonds issued by different firms, but denominated in the same currency. In that case, it is reasonable to assume that investors apply the same risk-free yield curve across different obligors when discounting bond cash flows. Another example—and the one we study in this paper—is government bonds issued by different member states of the euro. Here. it is again plausible to assume—as we will be doing—that investors discount cash flows using the same risk-free yield curve, but demand country-specific risk premia for assuming their country-specific risks.

Practically, we use the arbitrage-free Nelson-Siegel model derived in Christensen et al. (2011) with its well-known level, slope, and curvature factors to represent the frictionless risk-free yield curve common to all bonds issued in euros. This model is then augmented with country-specific risk factors to capture bond-specific risks in each national bond market using the approach developed in Andreasen et al. (2021, henceforth ACR). For each country, the identification of the country-specific liquidity risk factor comes from its unique loading, which mimics the idea that, over time, an increasing amount of the outstanding notional value of individual securities gets locked up in buy-and-hold investors' portfolios. This increases their sensitivity to variation in the marketwide liquidity risk captured by the country-specific liquidity risk factor. By observing prices for balanced panels of bonds in each country, their respective liquidity risk factors can be separately identified.

Although this approach can be applied equally well to standard nominal bonds, we limit our analysis to the euro-area markets for inflation-indexed government bonds, specifically those in France, Germany, Italy, and Spain. The main reason is that we are interested in extending the pioneering work of Christensen and Mouabbi (2024, henceforth CM) to offer an estimate of the natural rate r_t^* common to the entire euro area. With that in hand the model also allows us to provide a market-based measure of the stance of monetary policy representative for the entire euro area.

Underlying our analysis is an assumption of convergence of real rates across economies in the euro area. This is a key requisite for the common monetary policy operated by the European Central Bank to work and be transmitted in a reasonably uniform way across all member states in the Eurozone.

First, we find large and time-varying bond-specific risk premia in all four bond markets. However, in the German market, they are negative, meaning they represent convenience or safety premia, while they are large and positive in the Italian market consistent. Finally, the French inflation-indexed bond market, which is the largest of the four, has liquidity premia close to zero on average. Hence, this market can be interpreted to be the neutral benchmark market with the smallest price distortions.

Second, our natural rate r_t^* estimate and the associated market-based measure of the stance of monetary policy, both common to the entire euro area, are both very highly positively correlated with the corresponding estimates we get by using only the French data as in CM.

The remainder of the paper is structured as follows. Section 2 contains the description of our international panel of government bond prices. Section 3 details the no-arbitrage term structure model we use and summarizes our estimation results. Section 4 describes the calculation of the country-specific risk premia and examines their behavior. Section 5 describes our natural rate r_t^* estimate along with the associated market-based measure of the stance of monetary policy. Finally, Section 6 concludes the paper.

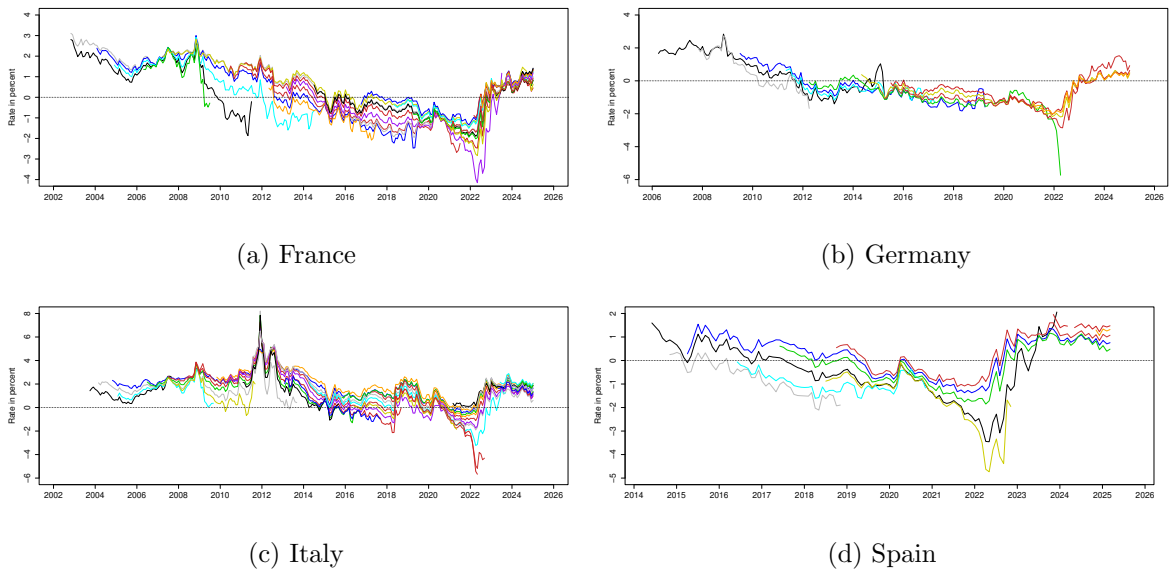
2 The Euro Area Inflation-Indexed Government Bond Data

A limited number of euro-area member states issue inflation-indexed debt: France, Germany, Italy, and Spain. In this section, we describe the data from each of these four government bond markets that we use in our empirical analysis.

To estimate the factors in our yield curve model, we use the prices of inflation-indexed government bonds. These are all marketable, non-callable bonds denominated in euros that pay a fixed rate of interest annually. All data are downloaded from Bloomberg.

Figure 1a shows the yields to maturity series for all French government bonds in our sample, which runs from October 2002 through the end of December 2024. This represents an update of the French government bond price sample analyzed in CM. Figure 1b illustrates the yields to maturity for all German government bonds in our sample, which covers the period from March 2006 through the end of December 2024. Figure 1c shows the yields to maturity series for all Italian government bonds in our sample from September 2003 to December 2024. Finally, Figure 1d shows the Spanish government bond prices converted into yield to maturity, which covers the period from May 2014 through the end of December 2024. We note that all the start dates are determined by data availability with the start dates for the German, Italian, and Spanish data coinciding with the launch of their respective inflation-indexed bond markets.

In general, real yield levels in all four countries trended lower between the early 2000s and 2021 followed by a sharp reversal in 2022. As a result, euro-area real yields are back close to where they started by the end of our sample. Furthermore, business cycle variation in the shape of the real yield curves is pronounced around the persistent trends in all four markets. Note that these yield curves tend to flatten ahead of recessions and steepen during the initial phase of economic recoveries. Finally and importantly, real yields are not subject to any lower bound constraints unlike nominal yields in the euro area during our sample period. This means that we can focus on models with Gaussian dynamics, which can easily handle negative interest rates.



(a) France (b) Germany

(c) Italy (d) Spain

Figure 1: **Yield to Maturity of Inflation-Indexed Government Bonds**
Illustration of Frecnh, German, Italian, and Spanish inflation-indexed government bond yields to maturity. The French sample starts in October 2002. The German sample starts in March 2006. The Italian sample starts in September 2003. Finally, the Spanish sample starts in May 2014. All samples end in December 2024.

3 Model Estimation and Results

In this section, we first detail the arbitrage-free Nelson-Siegel (AFNS) model that serves as the frictionless risk-free common real yield curve in our analysis before we introduce the augmented version with multi-country risk factors referred to as the AFNS-MC model. We then describe the restrictions imposed to achieve econometric identification of the model.

3.1 A Frictionless Arbitrage-Free Model of Real Yields

To capture the fundamental or frictionless factors operating the common real yield curve in the euro area, we choose to focus on the tractable affine dynamic term structure model introduced in Christensen et al. (2011).[1]

In this arbitrage-free Nelson-Siegel (AFNS) model, the state vector is denoted by $X_t = (L_t, S_t, C_t)$, where L_t is a level factor, S_t is a slope factor, and C_t is a curvature factor. The instantaneous risk-free real rate is defined as

$$r_t = L_t + S_t. \tag{1}$$

The risk-neutral (or $\mathbb{Q}$-) dynamics of the state variables used for pricing are given by the

[1] Although the model is not formulated using the canonical form of affine term structure models introduced by Dai and Singleton (2000), it can be viewed as a restricted version of the canonical Gaussian model; see Christensen et al. (2011) for details.

stochastic differential equations[2]

$$\begin{pmatrix} dL_t \\ dS_t \\ dC_t \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 \\ 0 & -\lambda & \lambda \\ 0 & 0 & -\lambda \end{pmatrix} \begin{pmatrix} L_t \\ S_t \\ C_t \end{pmatrix} dt + \Sigma \begin{pmatrix} dW_t^{L,\mathbb{Q}} \\ dW_t^{S,\mathbb{Q}} \\ dW_t^{C,\mathbb{Q}} \end{pmatrix}, \tag{2}$$

where Σ is the constant covariance (or volatility) matrix that is assumed to be diagonal, as recommended by Christensen et al. (2011).[3] Based on this specification of the $\mathbb{Q}$-dynamics, real zero-coupon bond yields preserve the Nelson-Siegel factor loading structure as

$$y_t(\tau) = L_t + \left(\frac{1-e^{-\lambda\tau}}{\lambda\tau}\right) S_t + \left(\frac{1-e^{-\lambda\tau}}{\lambda\tau} - e^{-\lambda\tau}\right) C_t - \frac{A(\tau)}{\tau}, \tag{3}$$

where $A(\tau)$ is a convexity term that adjusts the functional form in Nelson and Siegel (1987) to ensure absence of arbitrage (see Christensen et al. (2011)).

3.2 The AFNS-MC Model

In the augmented AFNS-MC model, we accommodate heterogeneity across euro-area government bond markets by allowing for country-specific risk factors, X_t^R, $R \in \{FRA, GER, ITA, SPA\}$.

The instantaneous risk-free rate remains defined as

$$r_t = L_t + S_t, \tag{4}$$

while the risk-neutral $\mathbb{Q}$-dynamics of the state variables used for pricing are given by

$$\begin{pmatrix} dL_t \\ dS_t \\ dC_t \\ dX_t^{FRA} \\ dX_t^{GER} \\ dX_t^{ITA} \\ dX_t^{SPA} \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \lambda & -\lambda & 0 & 0 & 0 & 0 \\ 0 & 0 & \lambda & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \kappa_{FRA}^{\mathbb{Q}} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \kappa_{GER}^{\mathbb{Q}} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \kappa_{ITA}^{\mathbb{Q}} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \kappa_{SPA}^{\mathbb{Q}} \end{pmatrix} \left[\begin{pmatrix} 0 \\ 0 \\ 0 \\ \theta_{FRA}^{\mathbb{Q}} \\ \theta_{GER}^{\mathbb{Q}} \\ \theta_{ITA}^{\mathbb{Q}} \\ \theta_{SPA}^{\mathbb{Q}} \end{pmatrix} - \begin{pmatrix} L_t \\ S_t \\ C_t \\ X_t^{FRA} \\ X_t^{GER} \\ X_t^{ITA} \\ X_t^{SPA} \end{pmatrix} \right] dt + \Sigma \begin{pmatrix} dW_t^{L,\mathbb{Q}} \\ dW_t^{S,\mathbb{Q}} \\ dW_t^{C,\mathbb{Q}} \\ dW_t^{FRA,\mathbb{Q}} \\ dW_t^{GER,\mathbb{Q}} \\ dW_t^{ITA,\mathbb{Q}} \\ dW_t^{SPA,\mathbb{Q}} \end{pmatrix},$$

where Σ is a lower-triangular matrix.

Based on the $\mathbb{Q}$-dynamics above, homogenous frictionless zero-coupon bond yields preserve a Nelson and Siegel (1987) factor loading structure as before

$$y_t(\tau) = L_t + \left(\frac{1-e^{-\lambda\tau}}{\lambda\tau}\right) S_t + \left(\frac{1-e^{-\lambda\tau}}{\lambda\tau} - e^{-\lambda\tau}\right) C_t - \frac{A(\tau)}{\tau}. \tag{5}$$

[2] As discussed in Christensen et al. (2011), with a unit root in the level factor, the model is not arbitrage-free with an unbounded horizon; therefore, as is often done in theoretical discussions, we impose an arbitrary maximum horizon.

[3] As per Christensen et al. (2011), $\theta^{\mathbb{Q}}$ is set to zero without loss of generality.

Importantly, due to the bond-specific risk premia in each of our four government bond markets, individual bond prices are sensitive to the variation in the country-specific risk factor X_t^R. As a consequence, the pricing of the bonds in each market is not performed with the standard discount function above, but rather with a discount function that accounts for the bond-specific risk:

$$\overline{r}_t^{R,i} = r_t + \beta^{R,i}(1 - e^{-\lambda^{R,i}(t-t_0^i)})X_t^R, \quad R \in \{FRA, GER, ITA, SPA\}, \tag{6}$$

where t_0^i denotes the date of issuance of the specific security and $\beta^{R,i}$ is its sensitivity to the variation in the market-wide bond-specific risk factor. Furthermore, the decay parameter $\lambda^{R,i}$ is allowed to vary across securities as well.

As shown in Christensen and Rudebusch (2019), the net present value of one consumption unit paid by bond i in country R at time $t+\tau$ has the following exponential-affine form

$$\begin{aligned} P_t^{R,i}(t_0^i, \tau) &= E^{\mathbb{Q}}\Big[e^{-\int_t^{t+\tau} \overline{r}^{R,i}(s,t_0^i)ds}\Big] \\ &= \exp\Big(B_1^{R,i}(\tau)L_t + B_2^{R,i}(\tau)S_t + B_3^{R,i}(\tau)C_t + B_4^{R,i}(t_0^i, t, \tau)X_t^R + A^{R,i}(t_0^i, t, \tau)\Big). \end{aligned}$$

This implies that the model belongs to the class of Gaussian affine term structure models. Note also that, by fixing $\beta^{R,i} = 0$ for all i and all R, we recover the AFNS model.

Now, consider the whole value of the bond from country R issued at time t_0^i with maturity at $t+\tau$ that pays a coupon C annually. Its price is given by[4]

$$P_t^{R,i}(t_0^i, \tau) = C(t_1 - t)E^{\mathbb{Q}}\Big[e^{-\int_t^{t_1} \overline{r}^{R,i}(s,t_0^i)ds}\Big] + \sum_{j=2}^{N} CE^{\mathbb{Q}}\Big[e^{-\int_t^{t_j} \overline{r}^{R,i}(s,t_0^i)ds}\Big] + E^{\mathbb{Q}}\Big[e^{-\int_t^{t+\tau} \overline{r}^{R,i}(s,t_0^i)ds}\Big]. \tag{7}$$

So far, the description of the AFNS-MC model has relied solely on the dynamics of the state variables under the $\mathbb{Q}$-measure used for pricing. However, to complete the description of the model and to implement it empirically, we will need to specify the risk premia that connect these factor dynamics under the $\mathbb{Q}$-measure to the dynamics under the real-world (or physical) $\mathbb{P}$-measure. It is important to note that there are no restrictions on the dynamic drift components under the empirical $\mathbb{P}$-measure beyond the requirement of constant volatility. To facilitate empirical implementation, we use the essentially affine risk premium specification introduced in Duffee (2002). In the Gaussian framework, this specification implies that the risk premia Γ_t depend on the state variables; that is,

$$\Gamma_t = \gamma^0 + \gamma^1 X_t,$$

[4]This is the clean price that does not account for any accrued interest and that maps to our observed bond prices.

where $\gamma^0 \in \mathbf{R}^7$ and $\gamma^1 \in \mathbf{R}^{7\times 7}$ contain unrestricted parameters.

Thus, the resulting unrestricted AFNS-MC model has $\mathbb{P}$-dynamics given by

$$dX_t = K^{\mathbb{P}}(\theta^{\mathbb{P}} - X_t) + \Sigma dW_t^{\mathbb{P}}.$$

This is the transition equation in the extended Kalman filter estimation of the AFNS-MC model.

3.3 Model Estimation and Econometric Identification

Due to the nonlinear relationship between state variables and bond prices in equation (7), the model cannot be estimated with the standard Kalman filter. Instead, we use the extended Kalman filter as in Kim and Singleton (2012); see Christensen and Rudebusch (2019) for details. Furthermore, to make the fitted errors comparable across bonds of various maturities, we scale each bond price by its duration. Thus, the measurement equation for the bond prices takes the following form

$$\frac{P_t^i(t_0^i, \tau^i)}{D_t^i(t_0^i, \tau^i)} = \frac{\widehat{P}_t^i(t_0^i, \tau^i)}{D_t^i(t_0^i, \tau^i)} + \varepsilon_t^i.$$

Here, $\widehat{P}_t^i(t_0^i, \tau^i)$ is the model-implied price of bond i, $D_t^i(t_0^i, \tau^i)$ is its duration, which is calculated before estimation, and ε_t^i represents independent and Gaussian distributed measurement errors with mean zero and a common standard deviation σ_ε. See Andreasen et al. (2019) for evidence supporting this formulation of the measurement equation.

4 The Bond-Specific Risk Premia

In this section, we analyze the bond-specific risk premia for each country implied by the estimated AFNS-MC model described in the previous section.

4.1 The Estimated Bond-Specific Risk Premia

We now use the estimated AFNS-MC model to extract the bond-specific risk premia in each bond market. To compute these premia, we first use the estimated parameters and the filtered states $\left\{X_{t|t}\right\}_{t=1}^T$ to calculate the fitted bond prices $\left\{\hat{P}_t^i\right\}_{t=1}^T$ for all outstanding securities in each market. These bond prices are then converted into yields to maturity $\left\{\hat{y}_t^{c,i}\right\}_{t=1}^T$ by solving the fixed-point problem

$$\begin{aligned}\hat{P}_t^i &= C(t_1 - t)\exp\left\{-(t_1 - t)\hat{y}_t^{c,i}\right\} + \sum_{k=2}^{n} C\exp\left\{-(t_k - t)\hat{y}_t^{c,i}\right\} \\ &\quad + \exp\left\{-(T - t)\hat{y}_t^{c,i}\right\},\end{aligned} \tag{8}$$

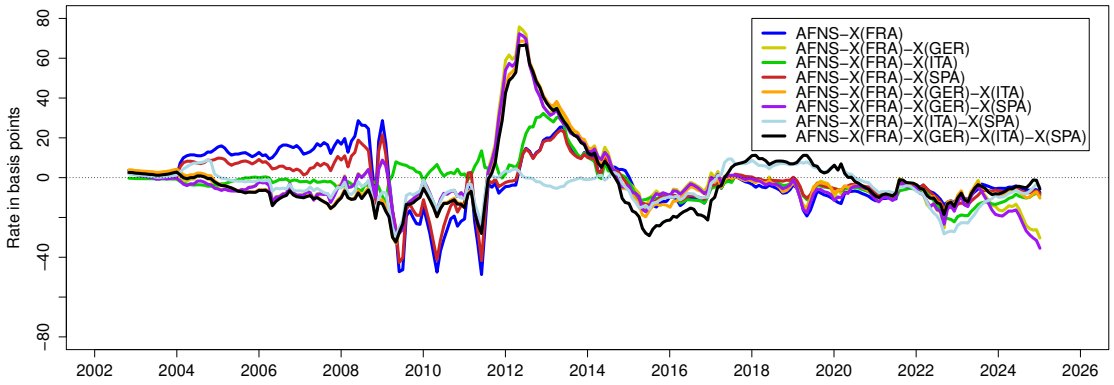


Figure 2: **Average Estimated French OAT€ Bond-Specific Risk Premium**
Illustration of the average estimated bond-specific risk premium of French OAT€s for each observation date implied by various AFNS-R models. The bond-specific risk premia are measured as the estimated yield difference between the fitted yield to maturity of individual OAT€s and the corresponding frictionless yield to maturity with the French bond-specific risk factor turned off.

for $i = 1, 2, ..., n_R$, meaning that $\left\{\hat{y}_t^{c,i}\right\}_{t=1}^{T}$ is approximately the real rate of return on the ith bond if held until maturity (see Sack and Elsasser 2004). To obtain the corresponding yields with correction for the bond-specific risk premia, we compute a new set of model-implied bond prices for each market from the estimated AFNS-MC model using only its frictionless part, i.e., using the constraints that $X_{t|t}^R = 0$ for all t as well as $\sigma_R = 0$ and $\theta_R^Q = 0$. These prices are denoted $\left\{\tilde{P}_t^i\right\}_{t=1}^{T}$ and converted into yields to maturity $\tilde{y}_t^{c,i}$ using equation (8). They represent estimates of the prices that would prevail in a world without any financial frictions or special demands for the bonds. The bond-specific risk premium for the ith OAT€ is then defined as

$$\Psi_t^{R,i} \equiv \hat{y}_t^{c,i} - \tilde{y}_t^{c,i}, \quad R \in \{FRA, GER, ITA, SPA\}. \tag{9}$$

Figure 2 shows the average estimated bond-specific risk premium $\bar{\Psi}_t^{FRA}$ across the outstanding French OAT€s at each point in time for all possible permutations of country-specific factor combinations. The key takeaway is twofold. First, the average estimated bond-specific risk premia in the French OAT€ market are very robustly estimated with little sensitivity to the inclusion of data and risk factors from other countries. Second, these premia are close to zero on average. This means that, according to our models, the prices in the French OAT€ market are not overly distorted in one direction or the other by bond-specific risk premia. This suggests that this market can viewed as a relatively neutral market that can usefully serve as a benchmark for understanding trends in real yields in the euro area as done in the analysis of CM.

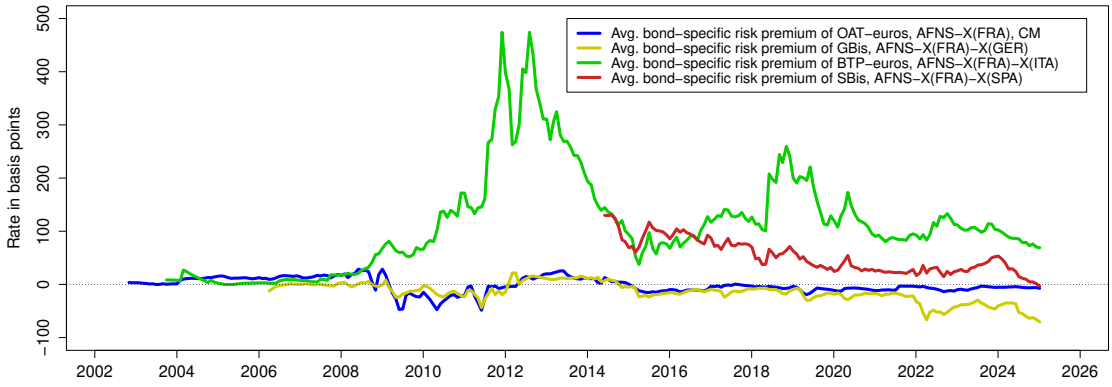


Figure 3: **Average Estimated Bond-Specific Risk Premia in Euro Area Inflation-Indexed Bond Markets**

Illustration of the average estimated bond-specific risk premium for each observation date for four classes of inflation-indexed bonds: French OAT€s, German GBi's, Italian BTP€s, and Spanish SBi's. In each case, the bond-specific risk premia are measured as the estimated yield difference between the fitted yield to maturity and the corresponding frictionless yield to maturity with the country-specific bond-specific risk factor turned off.

Figure 3 provides a comparison of the average estimated bond-specific risk premia across all four inflation-indexed bond markets. First, note that the French OAT€ market is the neutral benchmark among the four markets consistent with our earlier conclusion. Second, German GBi's trade at a safety premium, as also documented by Christensen and Mouabbi (2025). Spanish SBi's traded at a liquidity discount of about 100 basis points back in 2014 when the market was launched. Importantly, their average liquidity premium is estimated to have declined to near-zero by the end of our sample. In contrast, Italian BTP€s are priced with an upward trending liquidity discount during our sample. Moreover, their liquidity discount spiked sharply during the European sovereign debt crisis in 2011-2013, and the liquidity premia only normalized in 2015 after the ECB had launched its first large-scale government bond purchase program in January 2015.

5 The Common Natural Rate in the Euro Area

In this section, we examine the common natural rate r_t^* estimate implied by the AFNS-MC model.

5.1 Definition of the Natural Rate

Our working definition of the natural rate of interest r_t^* is

$$r_t^* = \frac{1}{5}\int_{t+5}^{t+10} E_t^{\mathbb{P}}[r_s^R]ds, \tag{10}$$

that is, the average expected real short rate over a five-year period starting five years ahead, where the expectation is with respect to the objective $\mathbb{P}$-probability measure. This 5yr5yr forward average expected real short rate should be little affected by short-term transitory shocks. Alternatively, r_t^* could be defined as the expected real short-term interest rate at an infinite horizon. However, this quantity will depend crucially on whether the factor dynamics exhibit a unit root. As is well known, the typical spans of time series data that are available do not distinguish strongly between highly persistent stationary processes and nonstationary ones. Our model follows the finance literature and adopts the former structure, so strictly speaking, our infinite-horizon steady-state expected real rate is constant. However, we view our data sample as having insufficient information in the ten-year to infinite horizon range to definitively pin down that steady state, so we prefer our definition with a medium- to long-run horizon. Moreover, we examine the sensitivity of our results to using alternative integration intervals in the definition r_t^* and find them to be robust.

Christensen and Mouabbi (CM) (2024) identify a preferred specification of the real-world $\mathbb{P}$-dynamics of the frictionless state variables with a mean-reversion $K^{\mathbb{P}}$-matrix given by

$$K_{CM}^{\mathbb{P}} = \begin{pmatrix} \kappa_{11}^{\mathbb{P}} & 0 & 0 \\ 0 & \kappa_{22}^{\mathbb{P}} & \kappa_{23}^{\mathbb{P}} \\ 0 & 0 & \kappa_{33}^{\mathbb{P}} \end{pmatrix}.$$

In the following, we adopt that specification and focus on the specification of the AFNS-MC model with a mean-reversion $K^{\mathbb{P}}$-matrix given by

$$K_{CMM}^{\mathbb{P}} = \begin{pmatrix} \kappa_{11}^{\mathbb{P}} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \kappa_{22}^{\mathbb{P}} & \kappa_{23}^{\mathbb{P}} & 0 & 0 & 0 & 0 \\ 0 & 0 & \kappa_{33}^{\mathbb{P}} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \kappa_{44}^{\mathbb{P}} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \kappa_{55}^{\mathbb{P}} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \kappa_{66}^{\mathbb{P}} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \kappa_{77}^{\mathbb{P}} \end{pmatrix}.$$

In Figure 4, we compare the r_t^* estimate implied by the AFNS-MC model with the r_t^* estimate we get when we update the analysis in CM using our French OAT€ bond data. Note the strikingly similar estimates. This underscores that the French OAT€ bond market

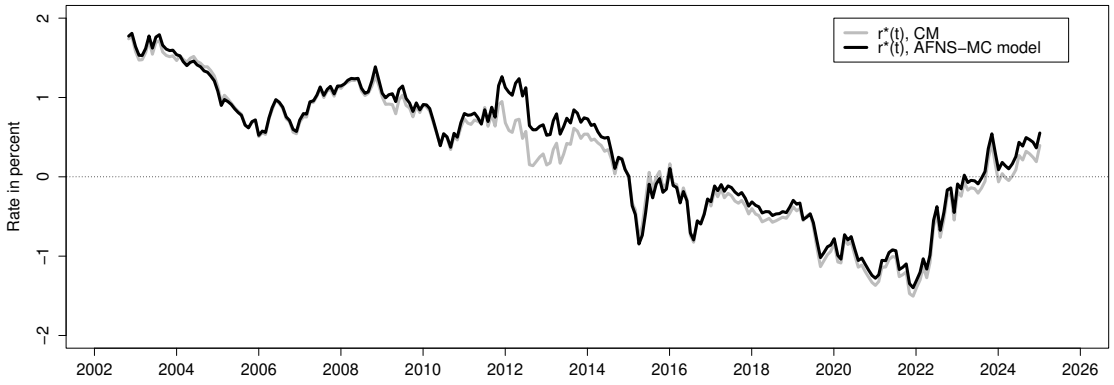


Figure 4: **Comparison with a Market-Based Estimate of r***

can be considered a neutral benchmark inflation-indexed bond market in the context of the euro area.

5.2 The Stance of ECB Monetary Policy

In this section, as a final application of our market-based estimate of r_t^*, we use it to construct measures of the stance of the ECB's monetary policy.

In theory, the stance of monetary policy would be given by the difference between the current real instantaneous short rate and its natural level as reflected in r_t^*, i.e., it would be defined as

$$\zeta_t = r_t - r_t^*.$$

The intuition behind this definition is straightforward. When the current real short rate is above its natural level, interest rates of all kinds are likely to be above their steady-state level and will provide some headwind for economic activity through higher borrowing costs and help slowdown the economy. And vice versa, when the current real short rate is below its natural level, the general interest rate level is likely to be below what is needed to maintain trend growth, and businesses and households may take advantage of that by making investments in new projects or housing at cheap financing rates, which will help boost economic activity.

To make this operational, we use the estimated frictionless one-year real yield from the AFNS-MC model as a proxy for the instantaneous real rate r_t.

In Figure 5, we compare the market-based estimate of ζ_t implied by the AFNS-MC model with the ζ_t estimate we get when we update the analysis in CM using our French OAT€ bond data. Again, the similarities are striking with a high positive correlation of 86 percent.

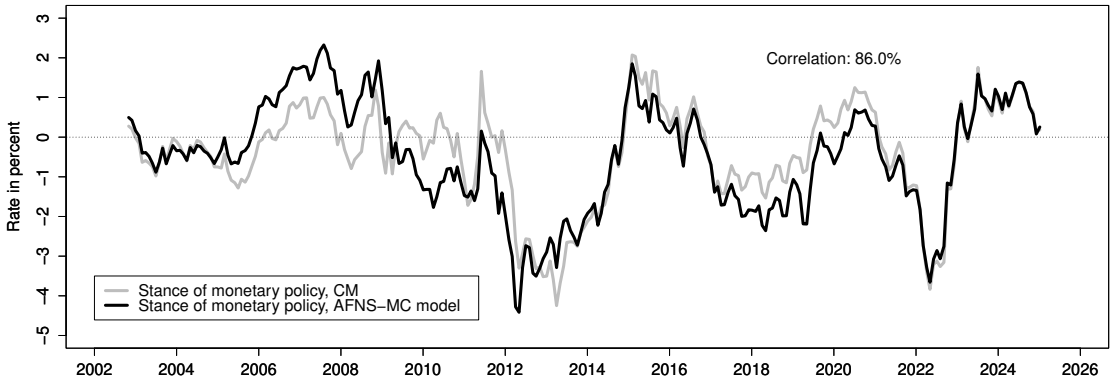


Figure 5: **Market-Based Measures of the Stance of Monetary Policy**

6 Conclusion

TO BE WRITTEN.

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