The Role of Liquidity and Term Premia in Emerging Bond Markets: Evidence from Mexico

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Contribution

- We use a state-of-the-art term structure model to account for both bond-specific liquidity and general term premia in Mexican bonos prices.
- Based on a careful model selection process, we provide a novel term premium estimate for Mexico that is purged of liquidity risk disturbances.
- Using regression analysis, we examine the determinants of the bonos liquidity and term premia.
- Finally, we analyze how Mexican and U.S. monetary policy surprises transmit to the various components of bonos yields.

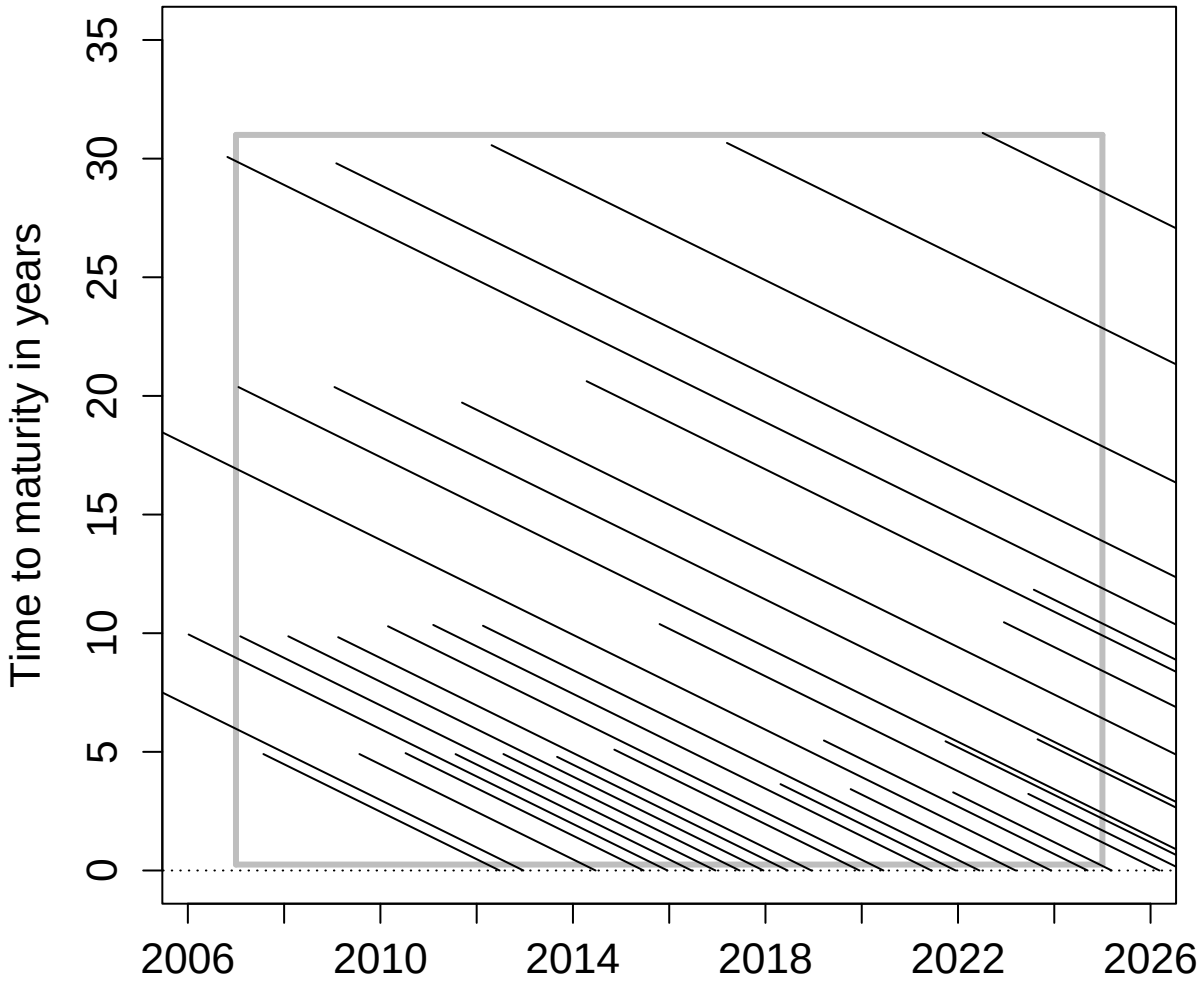
Findings

- Average bonos liquidity premia have increased in tandem with the aging of the bonds in this market.
- Bonos liquidity premia are significantly correlated with
  - Debt-to-GDP ratio;
  - Foreign share.
- The ten-year bonos term premium follows a stable but variable process. It ends our sample at a high level.
- Factors affecting bonos term premia include
  - Debt-to-GDP ratio;
  - Bid-ask spreads.
- Mexican and U.S. monetary policy surprises affect both the expectations and term premium components.
- Importantly, U.S. surprises generate notably stronger bonos yield reactions.

Outline

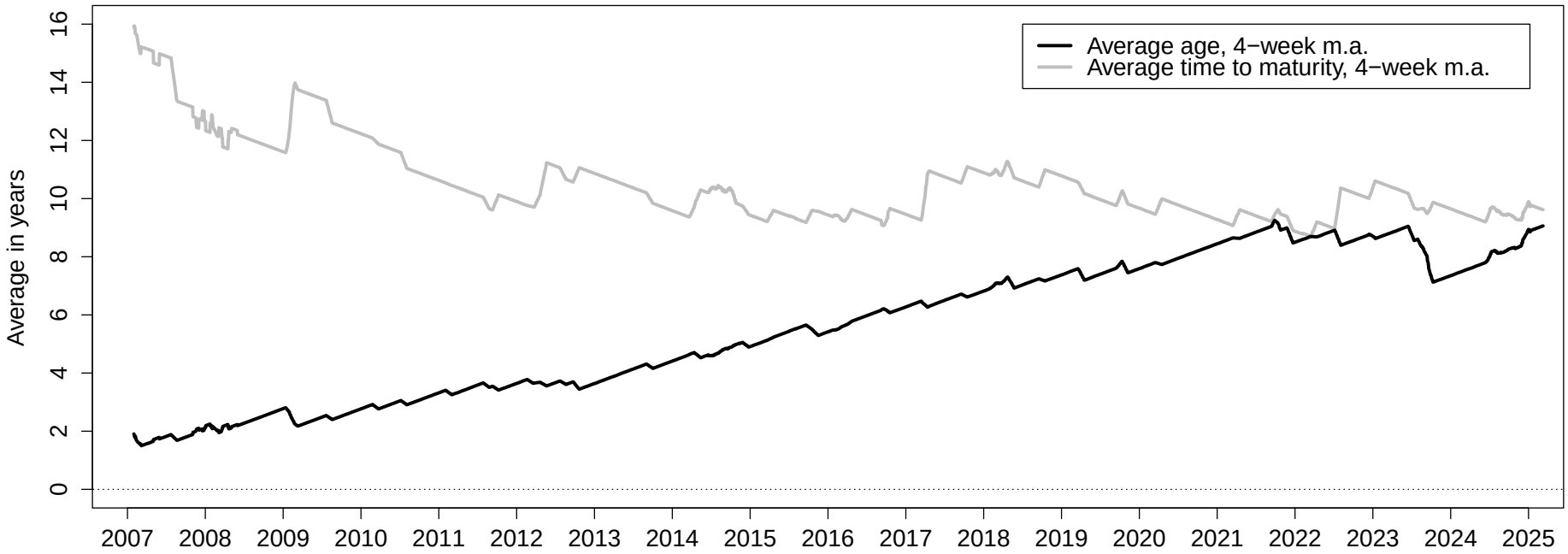
1. The bonos data
2. Term structure model with liquidity risk
3. The bonos liquidity premia
4. The bonos term premia
5. Local projections using monetary policy surprises
6. Conclusion

Maturity Distribution of Mexican Bonos



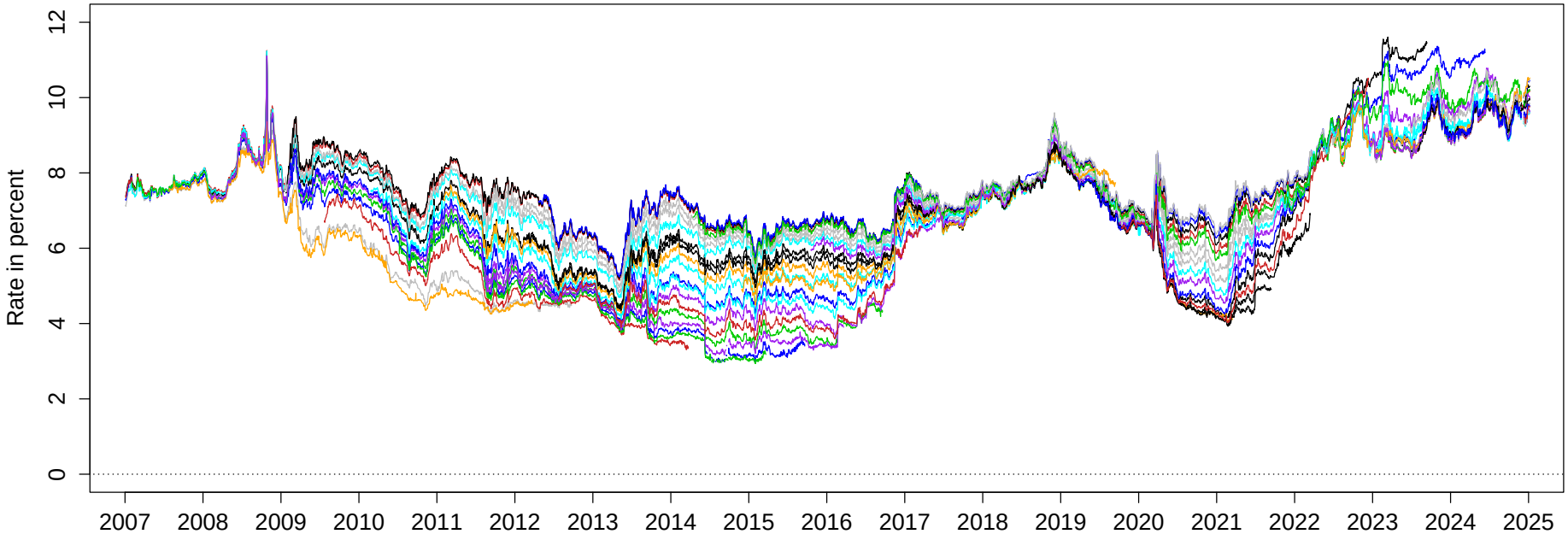
- Shown is the set of bonos included in our sample.
- Note that 5-, 10-, 20-, and 30-year bonos have been issued with some regularity.
- We use monthly bonos prices from 1/07 to 12/24.

Average Bonos Age and Time to Maturity



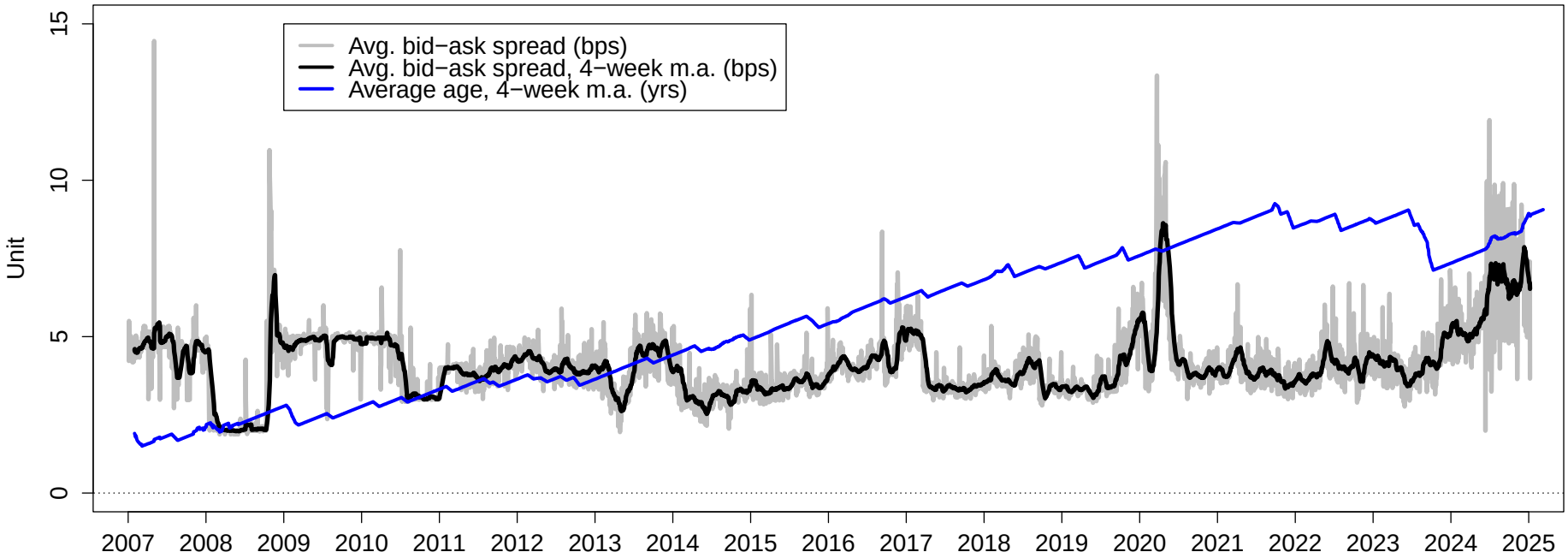
- Average bond age has increased from below 2 years to above 9 years.
- In contrast, the average remaining time to maturity has been on a downward trajectory since 2007.
- Do these persistent trends in bonos characteristics matter for their risk premia?

Bonos Yields – Why so High?



- Shown are the yields to maturity implied by the Mexican bonos prices downloaded from Bloomberg.
- Note the fair amount of variation in level and shape.
- Our yield curve model is designed to capture this.
- Why have bonos yields been so elevated recently?

Bonos Bid-Ask Spreads – Signs of Liquidity Risk?



- Bonos Bid-ask spreads average around 4 bps.
- Thus, liquidity risk is a valid concern for bonos investors.
- Mild positive correlation with the average bonos age.

Bonos Bid-Ask Spreads and Bond Age

Regression specification	Age_t^i	Number of parameters	Adj. R^2
OLS	0.0914***	2	0.001
	(0.028)		
Bond fixed effects	0.0918***	36	0.001
	(0.028)		
Time fixed effects	-0.0007	4,572	0.172
	(0.028)		
Bond & time fixed effects	0.0437	4,606	0.161
	(0.035)		

- For individual bonos bid-ask spreads we run the regression

$$BAS_t^i = \tau_t + \alpha_i + \beta Age_t^i + \varepsilon_t^i.$$

- Older bonos tend to have higher bid-ask spreads.
- Our model accounts for this dynamic liquidity pattern.

The Bonos Discount Function

- We follow Andreasen, Christensen, and Riddell (RF, 2021) and discount the cash flow of a given bonos indexed i with a bond-specific function:

$$\bar{r}_t^i = r_t + \beta^i(1 - e^{-\lambda^{L,i}(t-t_0^i)})X_t^{liq}.$$

- Time since issuance, t-t_0^i, is a proxy for the notion that, as time passes, an increasing fraction of a given security is held in buy-and-hold investors' portfolios and not available for trading.

- Forward-looking investors factor this into their trading strategies, which determines X_t^{liq} and the bonos liquidity premiums.

Note: This can be combined with any existing model of r_t.

The AFNS-L Model

We augment the arbitrage-free Nelson-Siegel (AFNS) model derived in Christensen, Diebold, and Rudebusch (JoE, 2011) with the bond-specific risk factor, denoted the AFNS-L model.

Its state variables, $X_t = (L_t, S_t, C_t, X_t^{liq})$, have $\mathbb{Q}$-dynamics:

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

Note: The liquidity risk factor, X_t^{liq}, is modeled as an independent Vasiček (1977) process under the $\mathbb{Q}$-measure.

In the AFNS-L model, the cash flow from the bond indexed *i* is discounted with the following exponential-affine function

$$\begin{aligned} P^i(t_0^i, t, T) &= E_t^{\mathbb{Q}} \left[e^{-\int_t^T (r_s + \beta^i (1 - e^{-\lambda^{R,i}(s - t_0^i)}) X_s^{liq}) ds} \right] \\ &= \exp\left(B^i(t_0^i, t, T)' X_t + A^i(t_0^i, t, T) \right). \end{aligned}$$

Model Equations and Estimation

- Using the essentially affine risk premia of Duffee (2002), the unrestricted AFNS-L model has $\mathbb{P}$-dynamics

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

  which is the transition equation in the Kalman filter estimation.

- The measurement equations take the form:

$$\frac{\overline{P}_t(t_0,\tau)}{D_t(t_0,\tau)} = \frac{\widehat{P}_t(t_0,\tau)}{D_t(t_0,\tau)} + \varepsilon_t,$$

  where $\widehat{P}_t(t_0,\tau)$ is the model price and $D_t(t_0,\tau)$ is its duration. See Andreasen et al. (2019) for robustness of this formulation.

- Due to the nonlinear measurement, the model is estimated with the extended Kalman filter; see Kim and Singleton (2012).

- For identification, the first issued thirty-year bonos in the data (11/18/2038 8.5%) has unit loading on the liquidity factor.

- Stationarity of the state variables is assumed throughout.

Calculation of the Bonos Liquidity Premiums

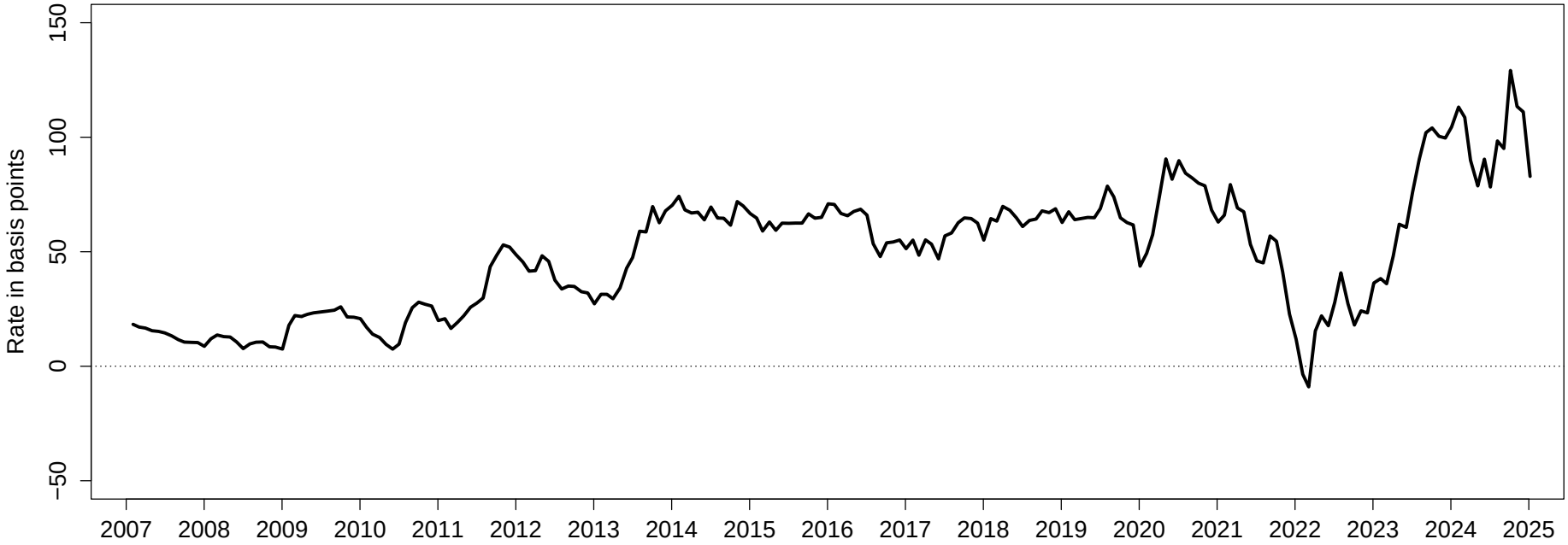
- First, we use the estimated parameters and the filtered states to calculate the fitted bonos prices $\hat{P}_t$.
- Second, we calculate the matching frictionless prices $\tilde{P}_t$ by switching off the liquidity factor and its parameters.
- These bond prices are then converted into yields to maturity by solving the fixed-point problem

$$\begin{aligned} P_t &= C(t_1 - t)\exp\{-(t_1 - t)y_t^c\} + \sum_{k=2}^{n} \frac{C}{2}\exp\{-(t_k - t)y_t^c\} \\ &\quad + \exp\{-(T - t)y_t^c\} \end{aligned}$$

  with the solutions denoted $\hat{y}_t^c$ and $\tilde{y}_t^c$, respectively.
- The liquidity premium for the ith bonos is then defined as

$$\Psi_t^i \equiv \hat{y}_t^{c,i} - \tilde{y}_t^{c,i}.$$

Average Bonos Liquidity Premium



- Shown is the average estimated bonos liquidity premium for the simple AFNS-L model with diagonal $K^{\mathbb{P}}$ and Σ.
- These premia are sizable and consistent with the findings of Christensen, Fischer, and Shultz (JIMF, 2021).
- Note also the persistent upward trend that aligns with the aging of the bonds in the bonos market.

Liquidity Premium Regression Results

Expl. variables	(1)	(2)	Individual regressions	
			$\widehat{\beta}$	adj. R^2
Foreign Share	0.69***	0.29	0.87***	0.23
	(0.17)	(0.28)	(0.17)	
Peso/USD rate	-8.00***	-5.13**	4.13***	0.29
	(1.70)	(2.53)	(0.78)	
WTI	-0.30**	-0.19	-0.45***	0.13
	(0.12)	(0.13)	(0.11)	
Debt-to-GDP	3.52***	4.86***	1.95***	0.48
	(0.43)	(0.93)	(0.24)	
Bid-ask spread	4.24**	0.06	6.77*	0.05
	(2.04)	(2.46)	(3.51)	
1m cetes rate	3.70***	4.72***	2.31	0.04
	(1.12)	(1.21)	(1.61)	
Other factors	No	Yes		
Adjusted R^2	0.67	0.73		

- The foreign share is important for bonos liquidity premia.
- Christensen et al. (2021) explain this with increased risk of flight-to-safety spells.

Term Premium Calculation

We define term premia in the standard way:

$$TP_t(\tau) = y_t(\tau) - \frac{1}{\tau}\int_t^{t+\tau} E_t^{\mathbb{P}}[r_s]ds,$$

where

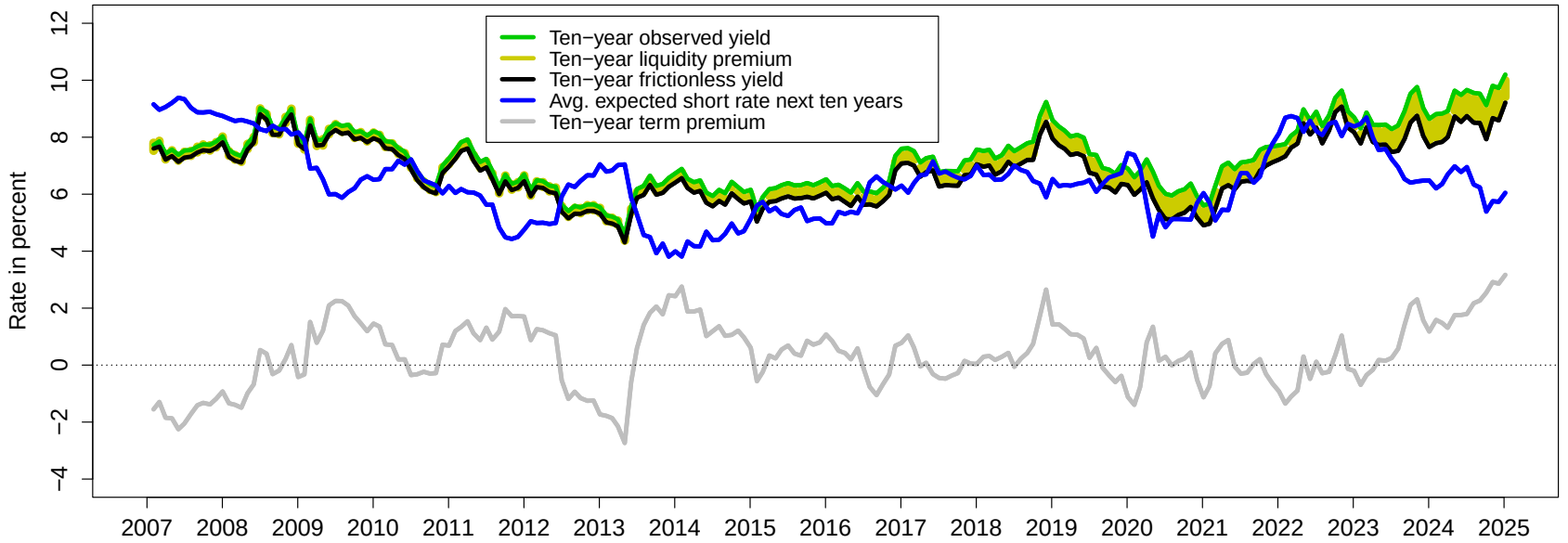
- $y_t(\tau)$ refers to the *frictionless* zero-coupon yield;
- $E_t^{\mathbb{P}}[r_s]$ is the expected future short rate.
- Note: $\mathbb{P}$-dynamics are important and carefully selected.

Preferred AFNS-L Model Specification

$K^{\mathbb{P}}$	L_t	S_t	C_t	X_t^{liq}	$\theta^{\mathbb{P}}$	Σ
L_t	0.8945	0	0	0.0843	0.0892	0.0112
	(0.3165)			(0.0589)	(0.0066)	(0.0005)
S_t	1.4299	0.4529	0	0.2399	-0.0186	0.0191
	(0.4962)	(0.2160)		(0.1522)	(0.0202)	(0.0014)
C_t	1.2375	0	1.0915	-0.2872	-0.0343	0.0280
	(0.5477)		(0.2838)	(0.1349)	(0.0251)	(0.0022)
X_t^{liq}	0	0	0	0.2213	-0.0501	0.0617
				(0.2803)	(0.0691)	(0.0094)

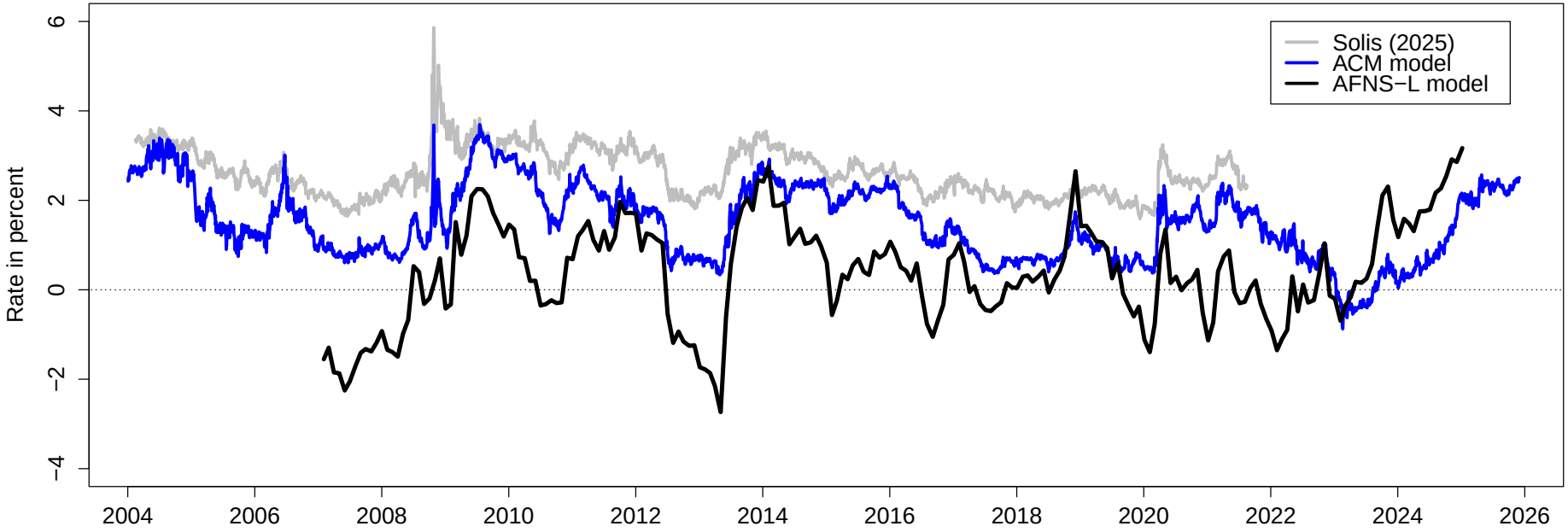
- The liquidity risk factor is independent.
- It is negatively correlated with L_t and S_t.
- Thus, periods with elevated liquidity risk tend to be followed by a lowering of short-term rates via S_t and to a lesser extent lower long-term yields via L_t.

Ten-Year Bonos Yield Decomposition



- Shown is the decomposition of the ten-year bonos yield based on our preferred AFNS-L model.
- The bonos term premium is stable but with occasional sharp gyrations.
- The persistent trends in long-term bonos yields are captured by the expectations component.

Comparison of Ten-Year Term Premium Estimates



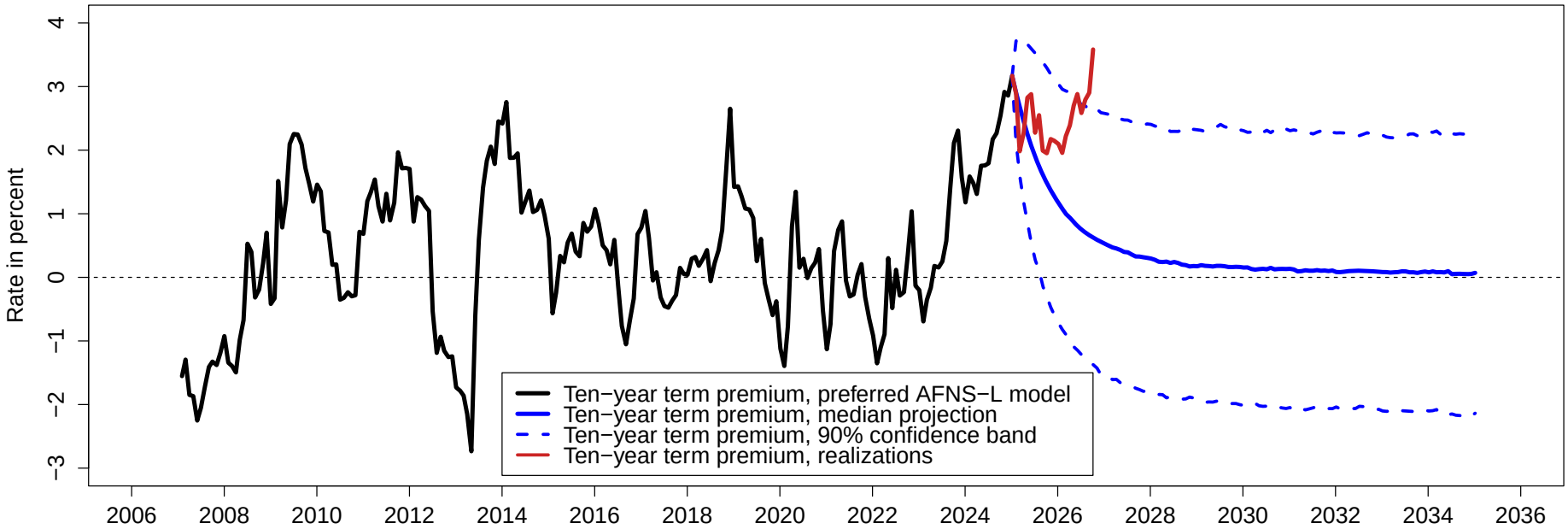
- Shown is the ten-year bonos term premium estimate from Solís (2025), who accounts for bonos credit risk premia, but not their liquidity premia.
- Also shown is the ten-year bonos term premium from an application of Adrian, Crump, Moench (ACM) (2013) by Aguilar-Argaez et al. (2024).
- Our ten-year term premium estimate tends to be lower as we account separately for the bonos liquidity premia.

Ten-Year Term Premium Regression Results

Expl. variables	(1)	(2)	Individual regressions	
			$\widehat{\beta}$	adj. R^2
Foreign Share	0.26	1.58	0.25	-0.00
	(1.33)	(1.63)	(1.06)	
Peso/USD rate	-22.10***	-31.52***	3.16	0.01
	(7.65)	(11.57)	(4.22)	
WTI	0.72	2.46***	0.32	-0.00
	(0.70)	(0.63)	(0.53)	
Debt-to-GDP	10.04***	27.77***	2.85*	0.05
	(2.71)	(3.93)	(1.55)	
Bid-ask spread	37.75***	16.39	34.10***	0.08
	(11.39)	(13.31)	(12.71)	
1m cetes rate	-0.97	-2.58	1.95	-0.00
	(5.24)	(5.55)	(6.12)	
Other factors	No	Yes		
Adjusted R^2	0.22	0.53		

- Debt-to-GDP and the peso-dollar FX rate are important for bonos term premia.
- Bid-ask spreads matter as well—maybe this reflects some residual liquidity component left behind.

Ten-Year Projections of Ten-Year Bonos Term Premia



- Following Christensen, Lopez, and Rudebusch (JME, 2015), we use simulations to generate probability-based projections of the ten-year bonos term premium as of Dec. 31, 2024.
- The median path suggests a fairly rapid reversal towards 0.
- Realized term premia so far have remained elevated.
- If factors are more persistent than stated, higher outcomes are more likely than indicated.

Local Projections using Monetary Policy Surprises

- We use local projections to study the transmission of monetary policy surprises to the ten-year bonos yield and its components.

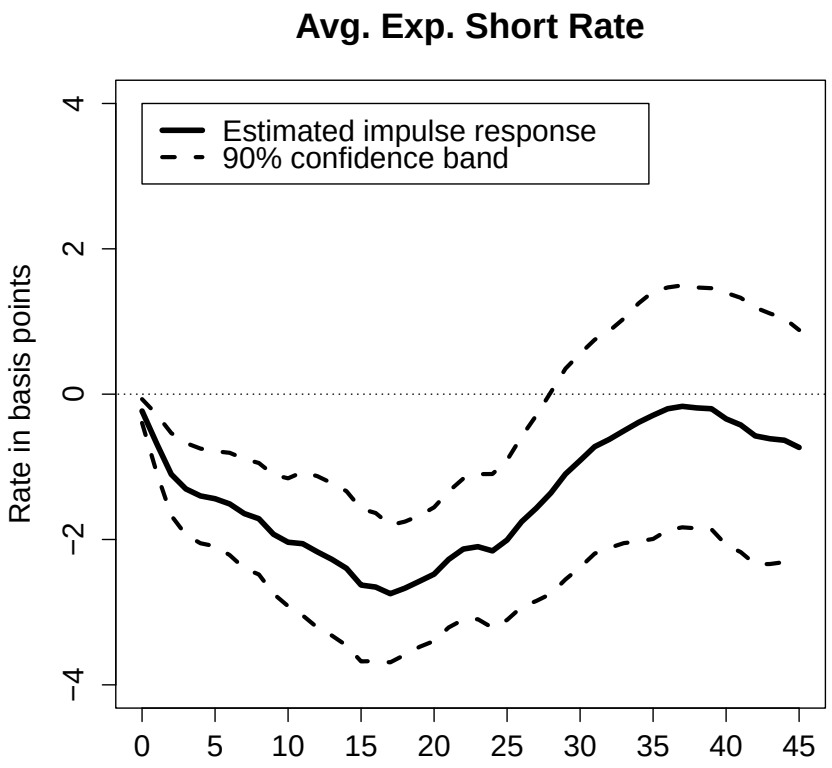
- Specifically, we run the following regressions:

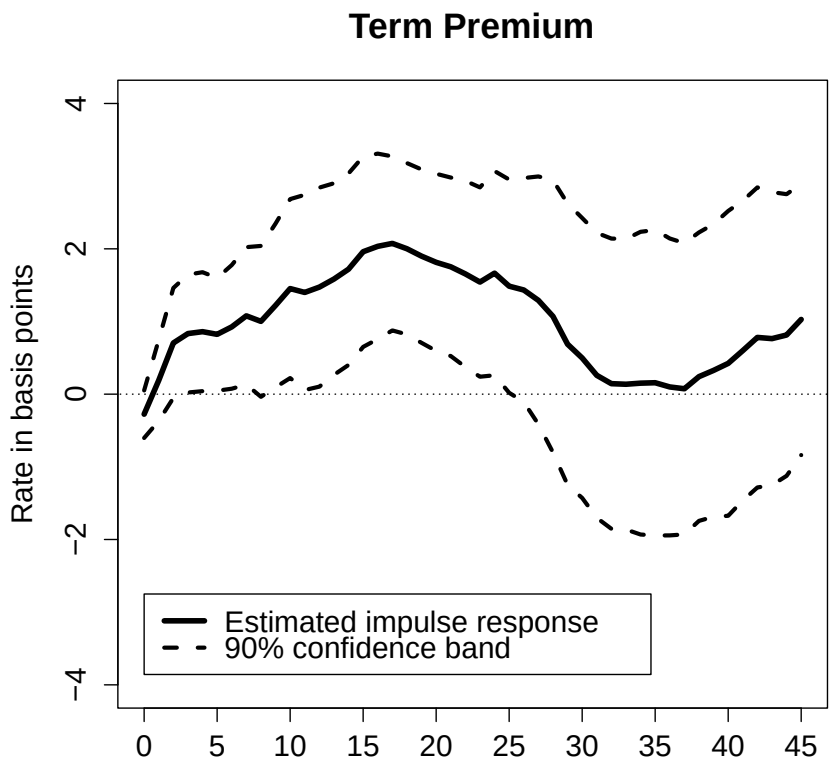
$$y_{t+h} - y_{t-1} = \sum_{j=1}^{3} \beta_h^j \epsilon_t^j + \eta_h s_{t-1} + u_{t+h},$$

  in which h indicates the horizon measured in days and each ϵ_t^j represents monetary policy surprises of type j.

- We use both Mexican and U.S. monetary policy surprises from Solís (2023) and Bauer and Swanson (2023), resp.

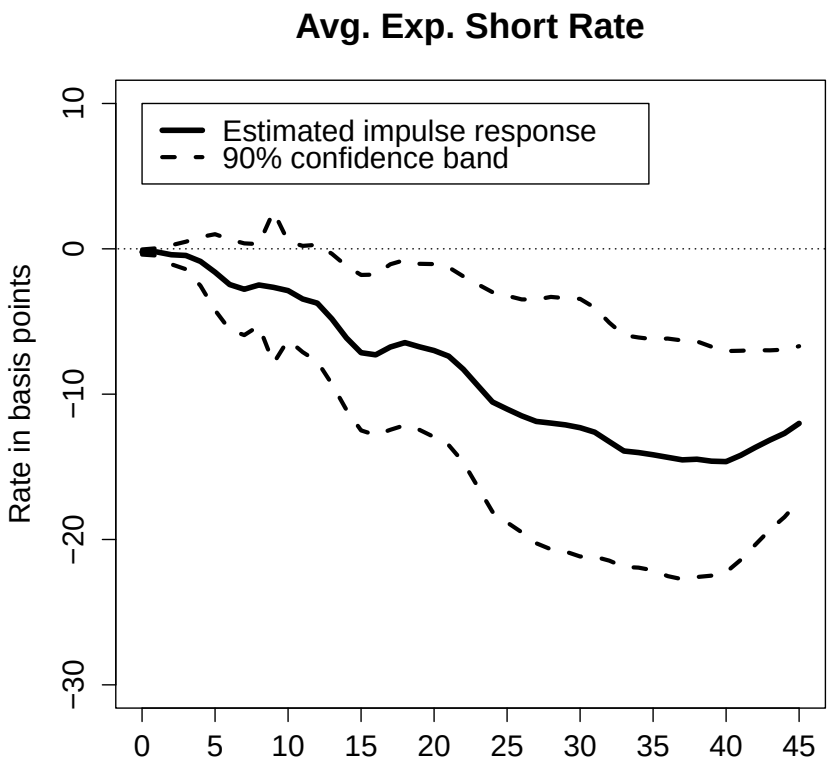
Response – Banxico Target Rate Surprise Easing

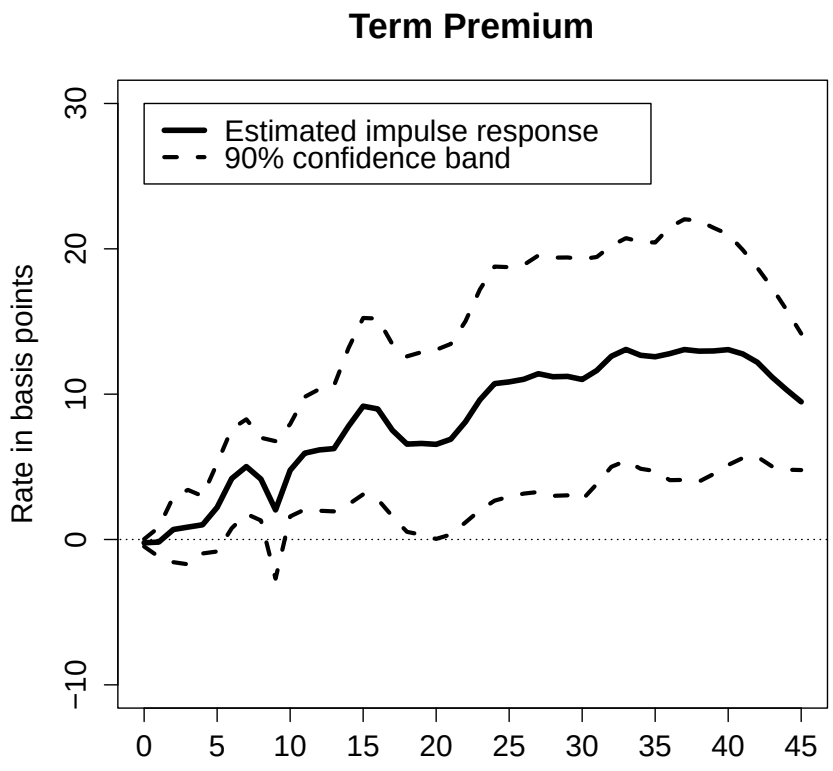




- Shown are the estimated impulse response functions of the ten-year expectations and term premium components to a 1-bp surprise target rate easing by Banxico.
- A surprise target easing lowers the expectations component significantly by a factor of 3 with partially offsetting effects through the term premium.

Response – Fed Target Rate Surprise Easing



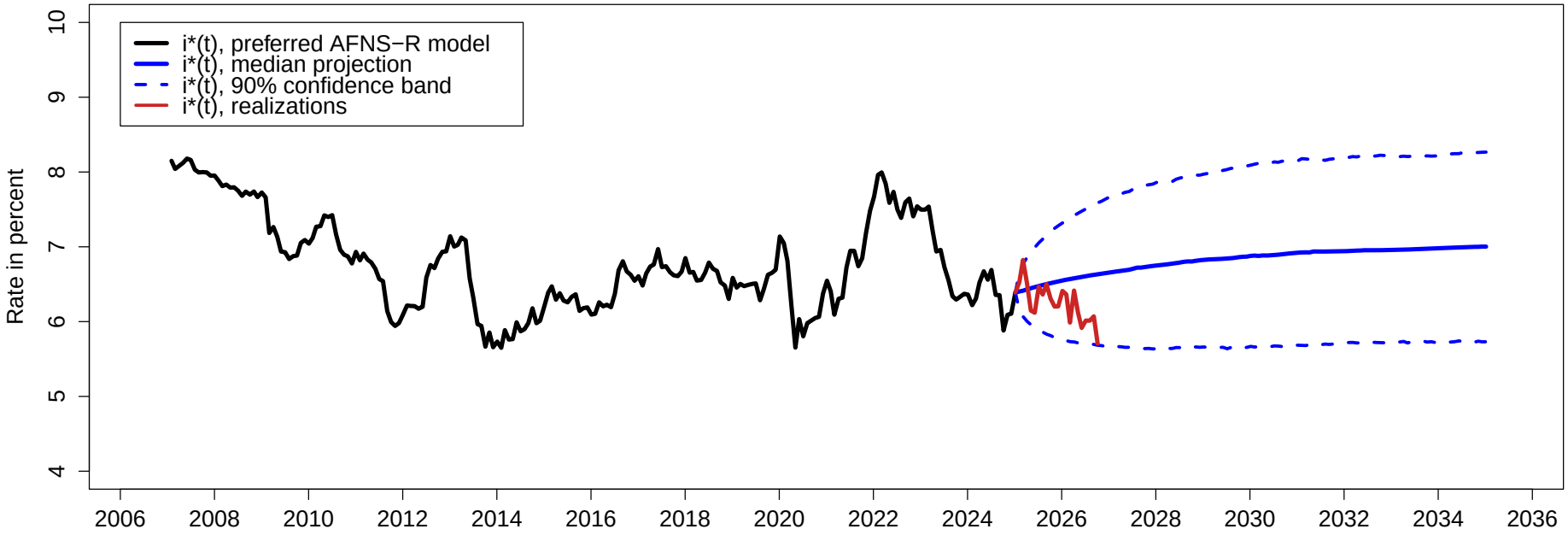


- Shown are the estimated impulse response functions of the ten-year expectations and term premium components to a 1-bp surprise target rate easing by the Fed.
- A Fed surprise target easing lowers the expectations component significantly by a factor of 15 with partially offsetting effects on the term premium.

Conclusion

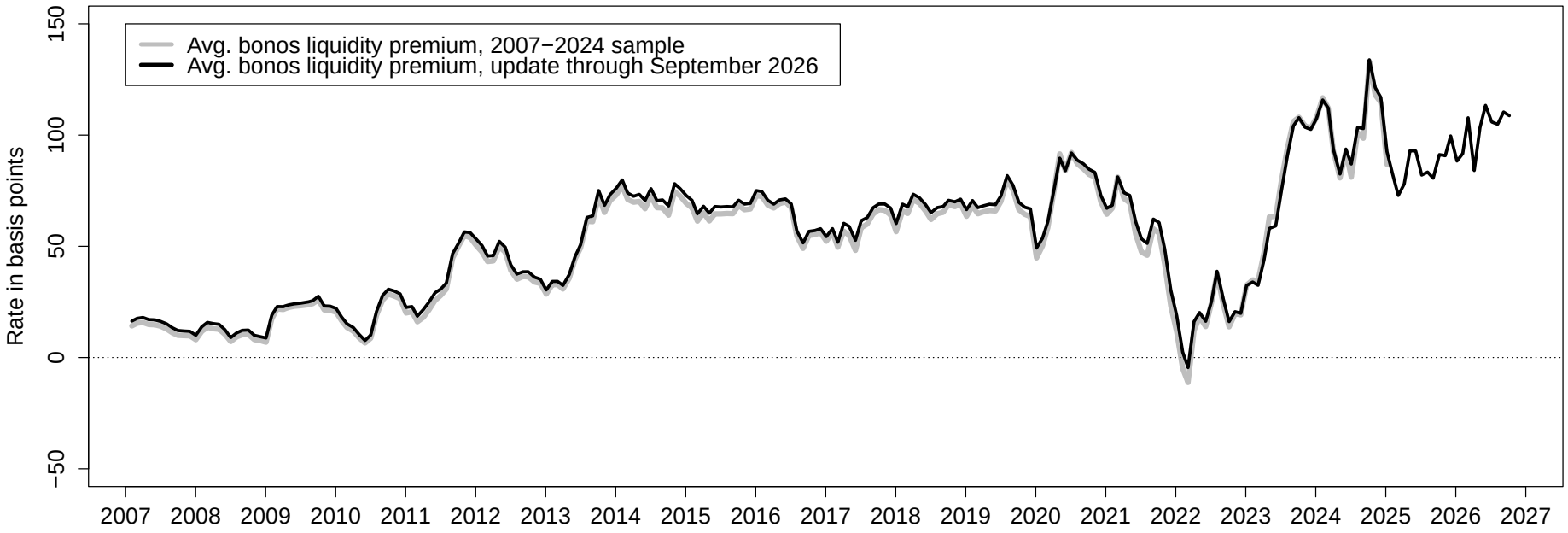
- We use a state-of-the-art term structure model to provide a novel term premium estimate of Mexican bonos yields, while also accounting for bonos liquidity risk premia.
- Bonos liquidity premia have trended higher since 2007 as outstanding bonos have aged. Also, they are positively correlated with debt-to-GDP and the foreign share.
- In contrast, bonos term premia are stable, but experience occasional sharp short-lived gyrations. They increase with rising debt-to-GDP and bonos bid-ask spreads.
- Model projections as of Dec 2024 suggested bonos term premia would revert towards zero, but realizations have been much higher than expected keeping yields high.
- Lastly, while Banxico is able to influence domestic bond yields via the expectations component, spillovers from U.S. monetary policy are orders of magnitude larger.

Ten-Year Projections of i^*



- Following Christensen, Lopez, and Rudebusch (JME, 2015), we use simulations to generate probability-based projections of i_t^* implied by the AFNS-L model as of Dec. 31, 2024.
- The median path suggests a gradual firming of i_t^*.
- However, realizations so far have continued the trend lower that started in 2022.

Average Bonos Liquidity Premium – Update



- Shown is the average estimated liquidity premium from our preferred AFNS-L model.
- For the overlapping sample analyzed in the paper these premia are very robustly estimated and barely change with updates.
- Note that bonos liquidity risk premia have remained elevated since 2023.