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Discussion of Haddad, Moreira, and Muir's

"Asset Purchase Rules: How QE Transformed the Bond Market"

Thomas King
FRB Chicago*

Advances in Macro-Finance Research

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* The views expressed herein are not official positions of the Federal Reserve Bank of Chicago or the Federal Reserve System.

The Vayanos-Vila view of bond pricing

Log bond prices are

$$p_t^{(\tau)} \approx \mathrm{E}_t\left[p_{t+1}^{(\tau-1)}\right] - r_t - \underbrace{\gamma X_t^{(\tau*)}\left(\rho_{\tau*,\tau}\mathrm{std}_t\left[p_{t+1}^{(\tau*)}\right]\mathrm{std}_t\left[p_{t+1}^{(\tau)}\right]\right)}_{\textit{risk premium}}$$

bond holdings ($X_t^{(\tau*)}$)

The effects of bond supply are

$$\frac{E_t\left[p_{t+1}^{(\tau)}\right]}{\partial X_t^{(\tau*)}} \approx -\gamma\left(\rho_{\tau*,\tau}\mathrm{std}_t\left[p_{t+1}^{(\tau*)}\right]\mathrm{std}_t\left[p_{t+1}^{(\tau)}\right]\right)$$

Higher price volatility leads to

- ***Higher term premia*** on average
- ***Bigger effects of bond supply*** on yields

One source of price volatility is variation in $X_t^{(\tau*)}$.

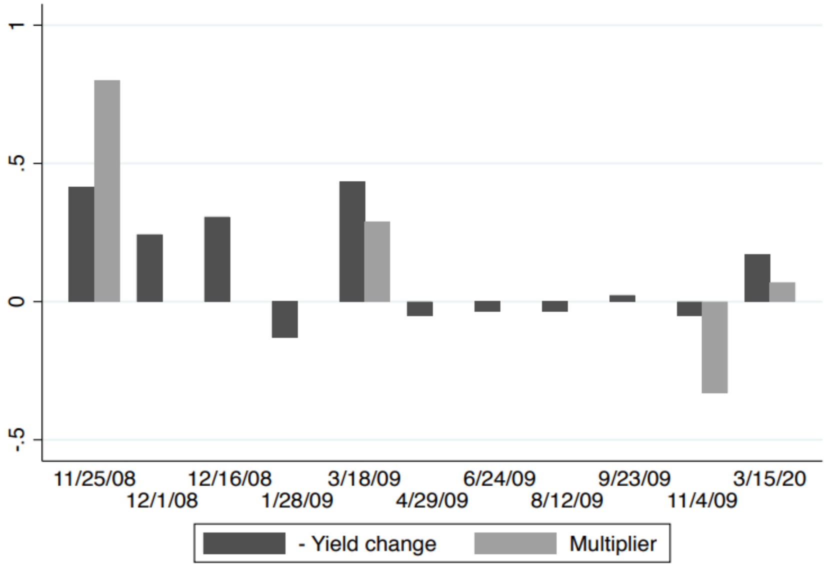
What does the HMM QE rule do?

Lowers volatility in $X_t^{(\tau*)}$ by having the Fed buy bonds in proportion to outstanding:

$$\boldsymbol{qe_t = \frac{1}{3} s_t}$$

- This dampens the volatility of prices ($\text{std}_t\left[p_{t+1}^{(\tau)}\right] \downarrow$), leading to:
  - Lower term premia on average.
  - Smaller effects of bond supply on term premia.

Event-study evidence



- Does not control for ***expectations***—estimating multipliers requires measuring surprise (D'Amico & Seida, 2024).
- Other things going on too:
  - March 2009 reaction was mostly "***local supply***" effects (D'Amico & King, 2013).
  - ***Signaling*** effects also matter (Bauer & Rudebusch, 2014).

Regression evidence

Authors show that after 2008:

- Yield curve ***slope*** is lower.
- Yield ***sensitivity*** to bond supply is smaller.
  - replicating King (2019)

Two explanations:

- HMM (2024): investors learned the ***QE rule***.
- King (2019): rates were close to the ***ZLB***.

Why might the ZLB explain these results?

$$p_t^{(\tau)} \approx \mathrm{E}_t\left[p_{t+1}^{(\tau-1)}\right] - r_t - \gamma X_t^{(\tau*)}\left(\rho_{\tau*,\tau}\,\mathbf{std}_t\left[\boldsymbol{p}_{t+1}^{(\tau*)}\right]\mathbf{std}_t\left[\boldsymbol{p}_{t+1}^{(\tau)}\right]\right)$$

At the ZLB, yield volatility falls because of the lower-bound truncation ($\mathrm{std}_t\left[p_{t+1}^{(\tau)}\right]\downarrow$).

Reduced volatility leads to:

- Lower term premia on average.
- Smaller effects of bond supply on term premia.

Only need to be ***near*** the ZLB for this to kick in.

- Because bonds are forward-looking, attenuation can arise when r_t is as high as 2%.

HMM's empirical controls for ZLB do not distinguish this from the QE-rule story.

How important was the ZLB?

Mertens & Williams (2021): "The lower bound has a ***sizable effect*** on the distribution of interest rates."

- Options data imply investors expected to be near ZLB ***most*** of the time.

Model-based evidence:

Table 1: Effective Lower Bound Risk

	Probability of ELB by 2021:Q4	Probability of ELB by 2024:Q4	Probability of ELB by 2029:Q4
Time-series models			
Del Negro and others (2017)	21	35	51
Johannsen and Mertens (2018)	4	14	28
Lubik and Matthes (2015)	2	7	12
DSGE models			
FRB Chicago, $r^{LR} = 0.5$	13	23	41
FRB Chicago, $r^{LR} = 1.0$	7	15	29
FRB Chicago, $r^{LR} = 1.5$	4	9	19
FRB New York, $r^{LR} = 1.9$	24	39	51
FRB/US model (June 2019 SEP, $r^{LR} = 0.5$)	27	48	68
Addendum			
Survey of Primary Dealers (Median, July 2019)	35	n.a.	n.a.

Source: Duarte, Johanssen, Melosi, Nakata (2019)

"The proximity of interest rates to the ELB has become the preeminent monetary policy challenge of our time." – Jerome Powell, 2019.

QE rules and ZLB are coextensive.

It is inconsistent to argue that the ZLB is irrelevant but QE is relevant.

- HMM assume after 2008 the QE rule is ***always*** in effect.
- In reality QE ***only*** happens at the ZLB.

For QE rule to matter, ZLB must have a significant probability of binding.

- But that changes the properties of the model.

Need a model that incorporates ***both***....

QE rules with the ZLB

Adjust the HMM model by making the short rate follow a shadow-rate process:

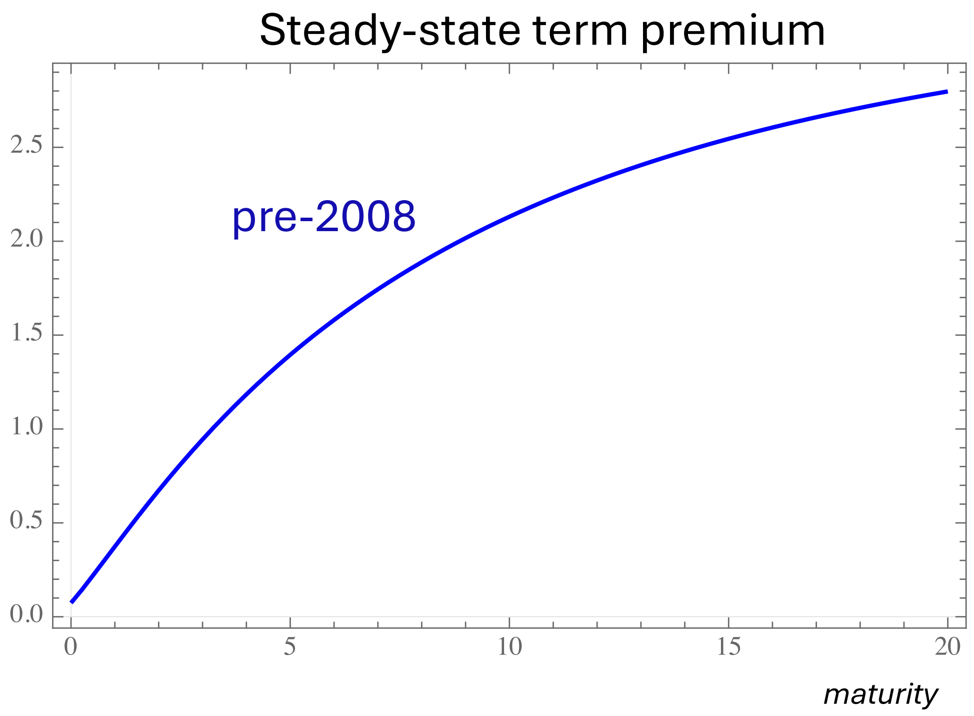
$$\hat{r}_t = \hat{r}^* + 0.95(\hat{r}_t - r^*) + \epsilon_t^r \qquad \epsilon_t^r \sim \mathrm{N}(0, 0.009)$$ ← *(estimated over 1954 - 2008)*

$$r_t = \max[0, \hat{r}_t]$$

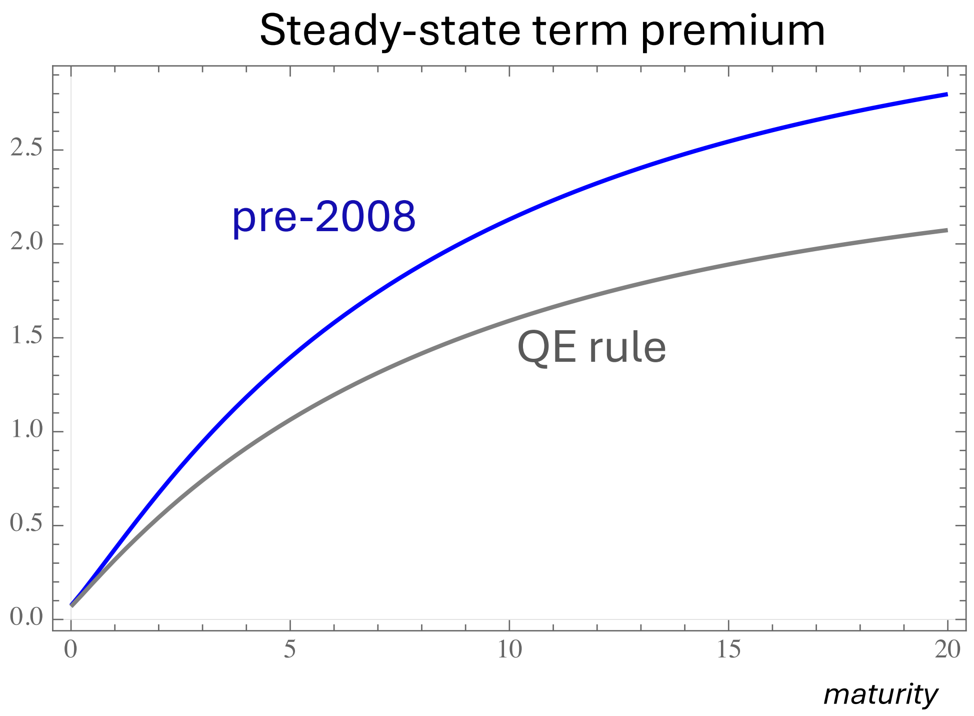
- Other parameters calibrated to (roughly) match authors' results.

- $\hat{r}^*$ is steady-state (nominal) short rate – this matters when there is a ZLB.
  - Calibrate to 5% for pre-2008.
  - Then change to match post-2008 average of 1%.

QE rule and ZLB both lower the term premium.



QE rule and ZLB both lower the term premium.



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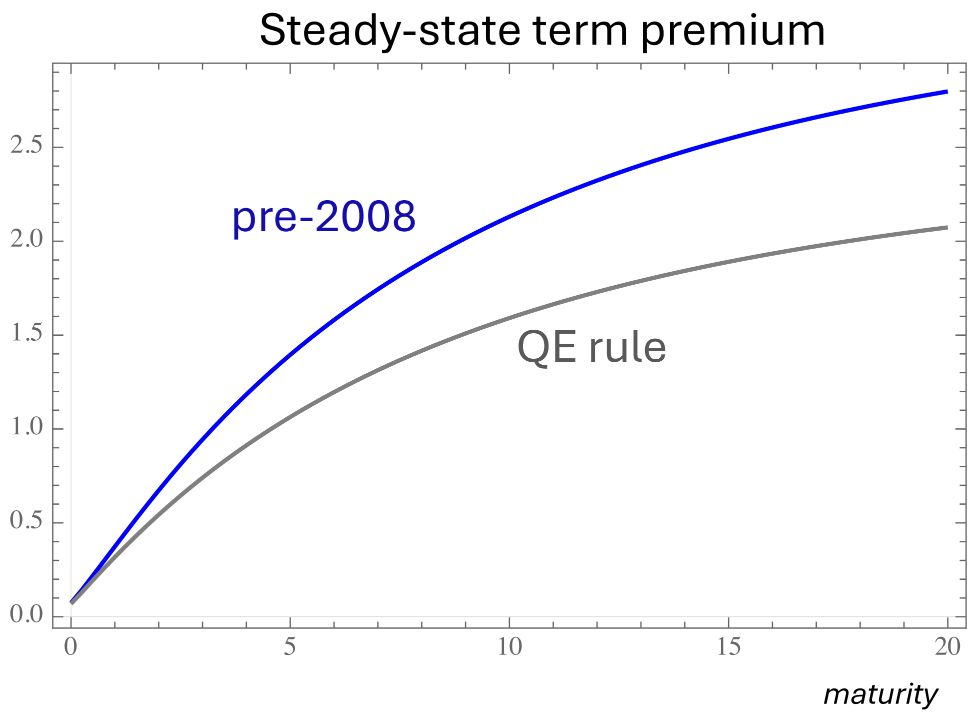

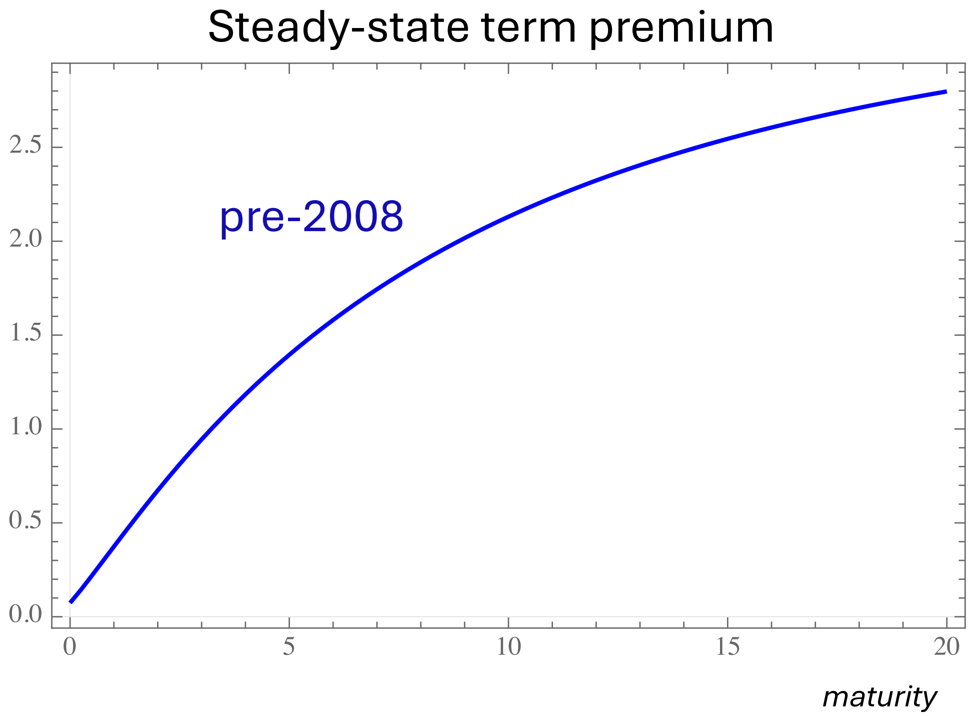

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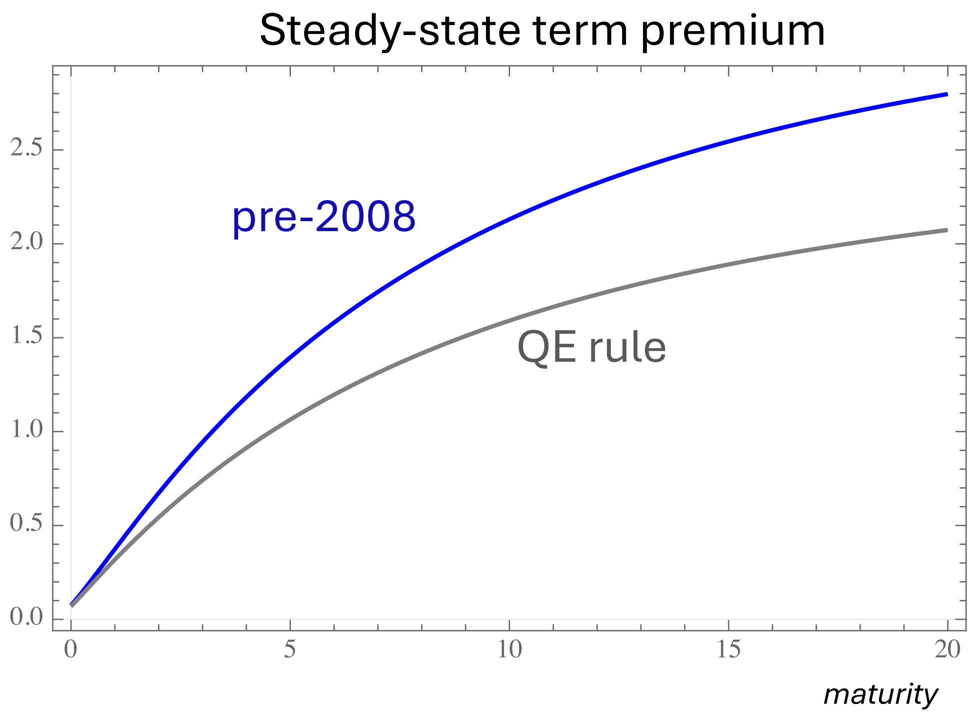
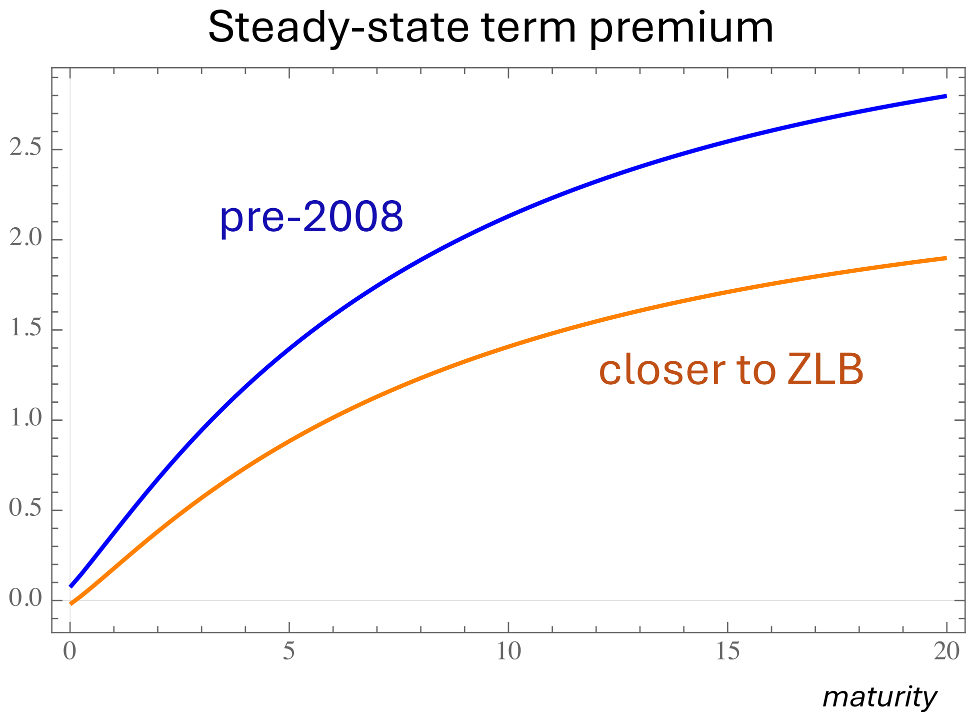
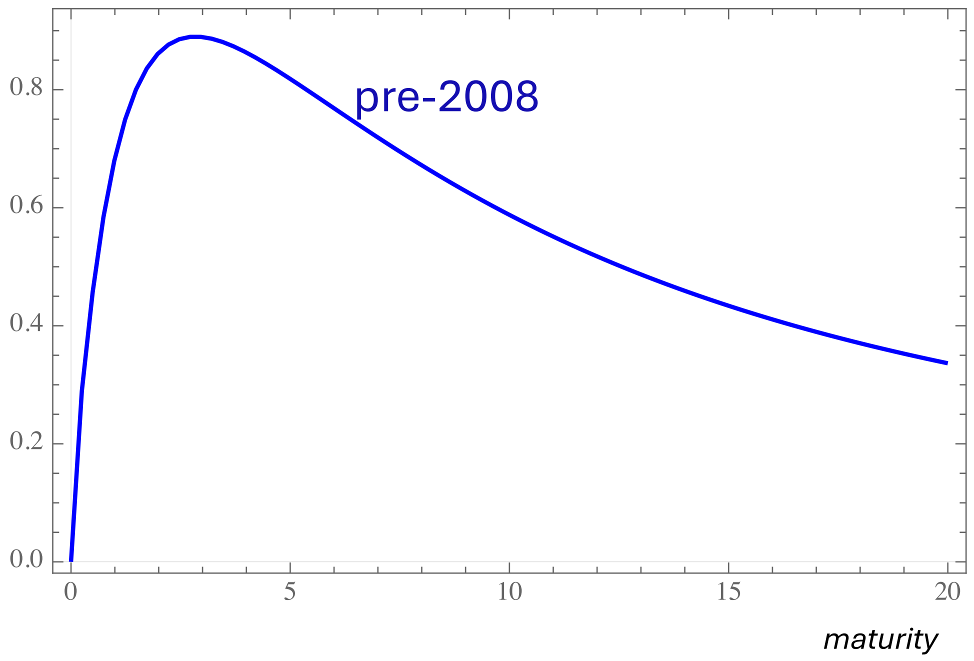




QE rule and ZLB both lower loadings on bond supply.

Bond supply effect on TP at steady state



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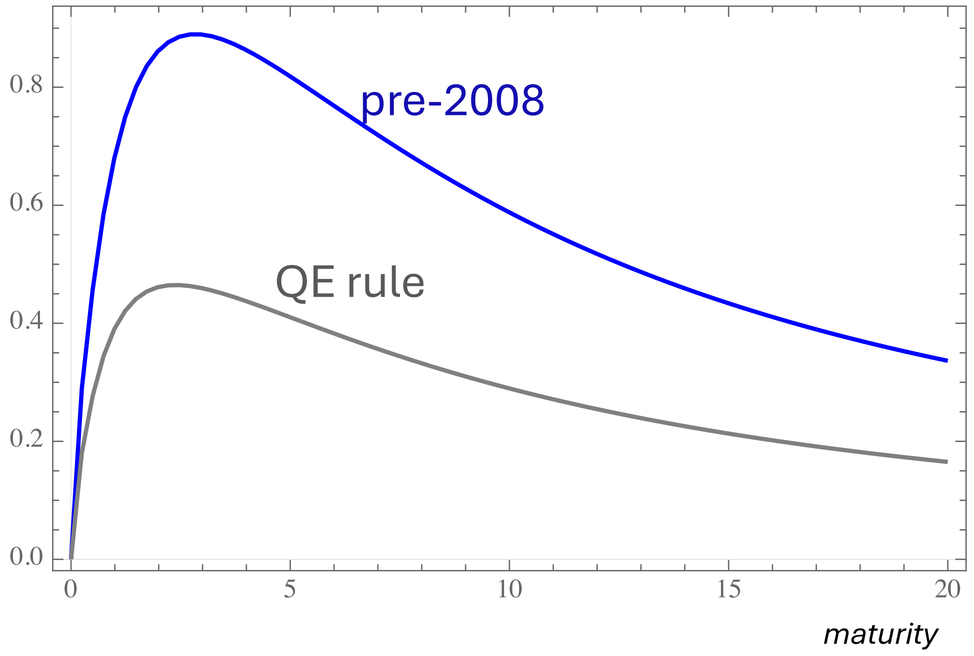

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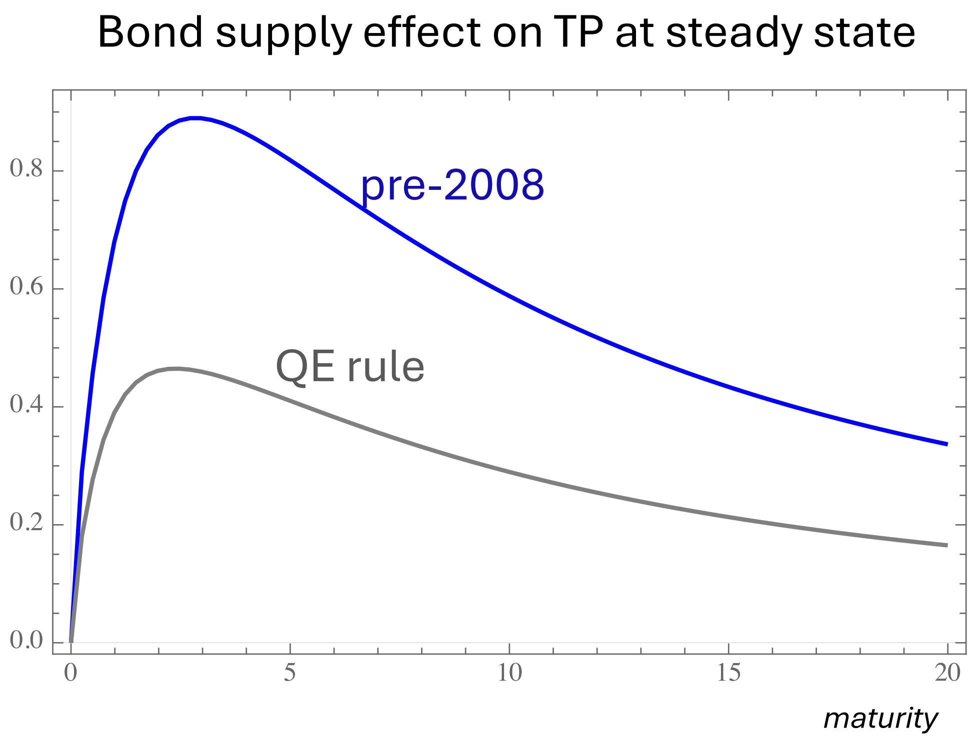

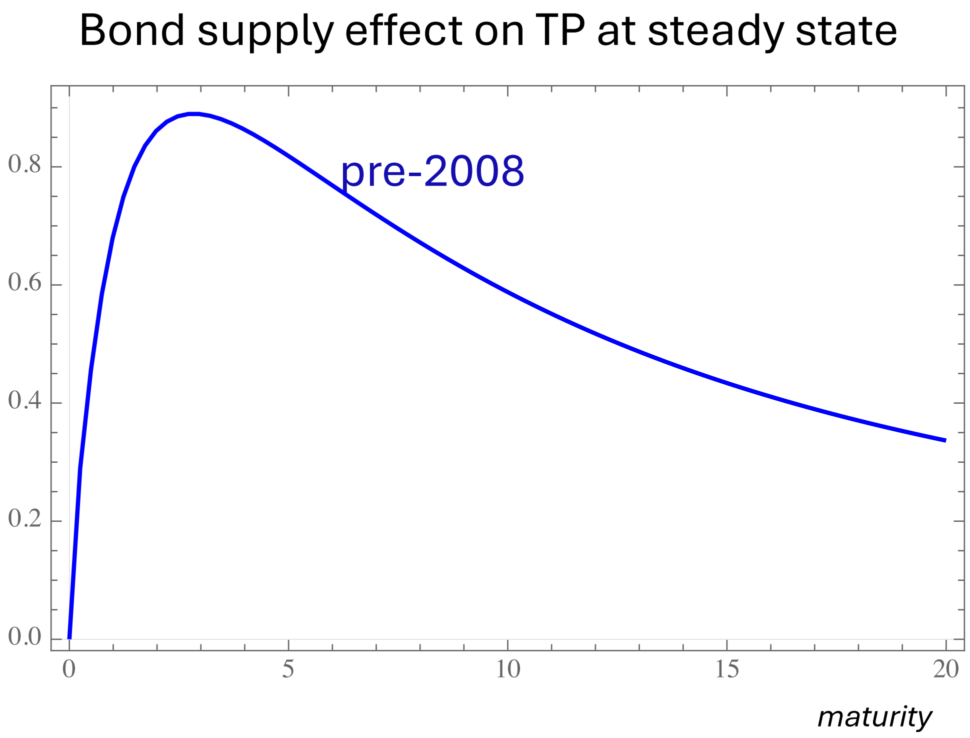

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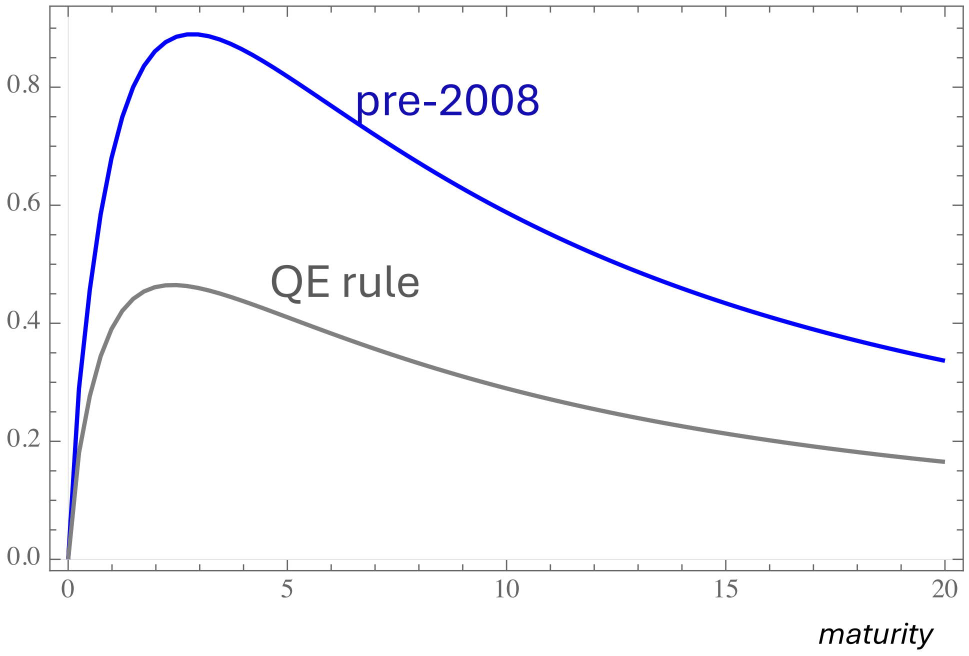

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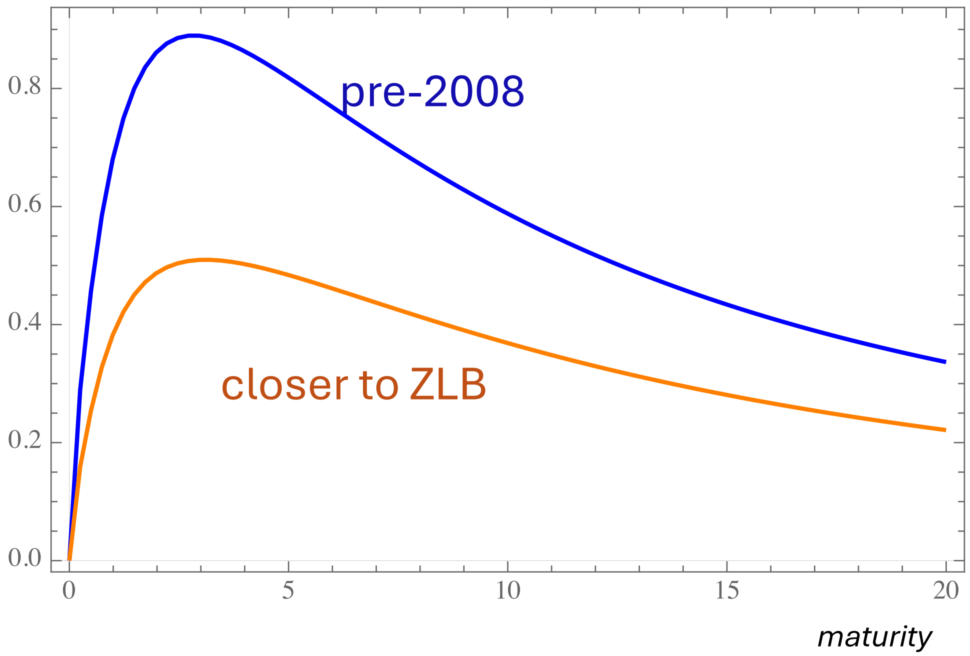
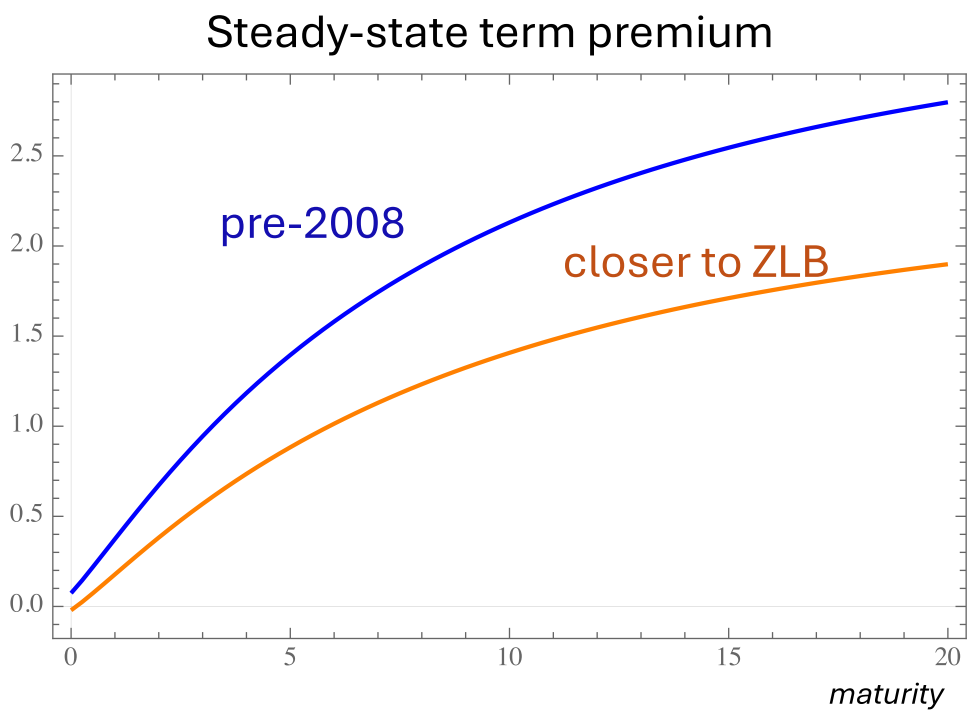
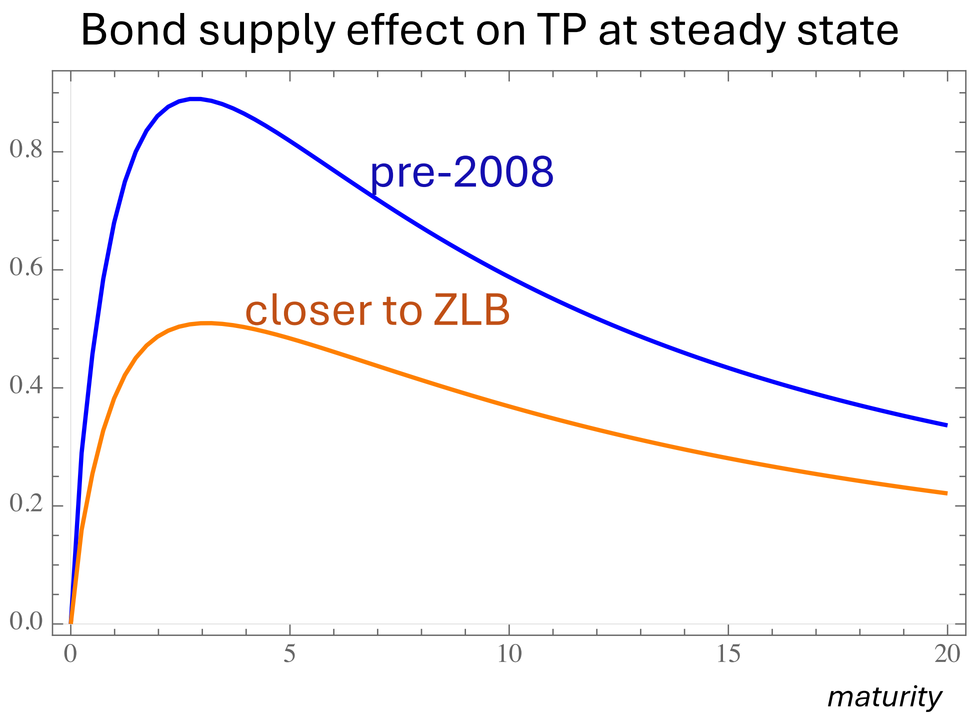


ZLB + QE rule

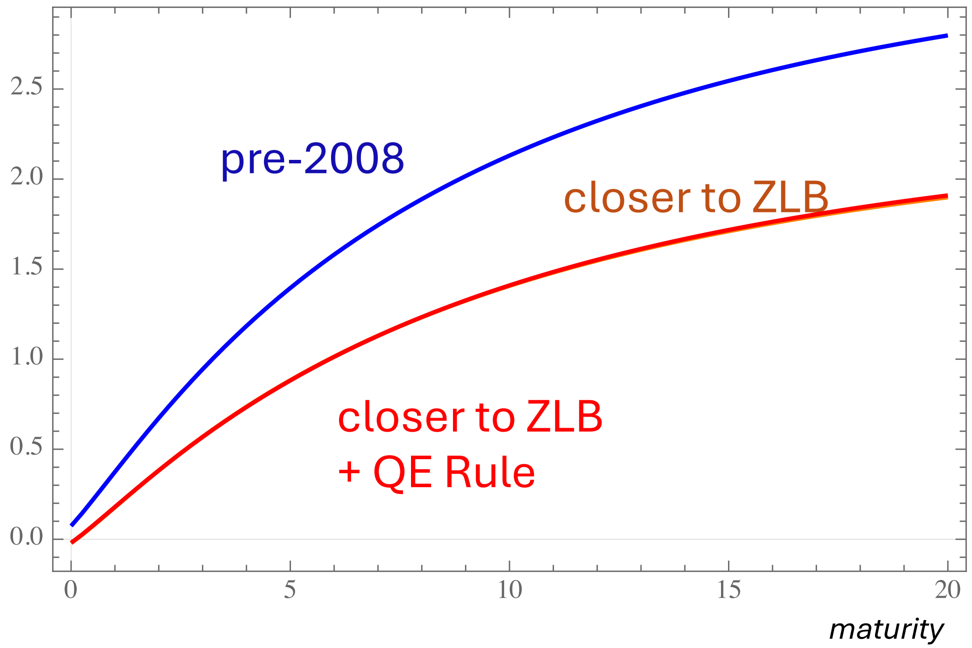




- Now assume QE rule applies, but only at the ZLB…

ZLB + QE rule ≈ ZLB alone

Steady-state term premium



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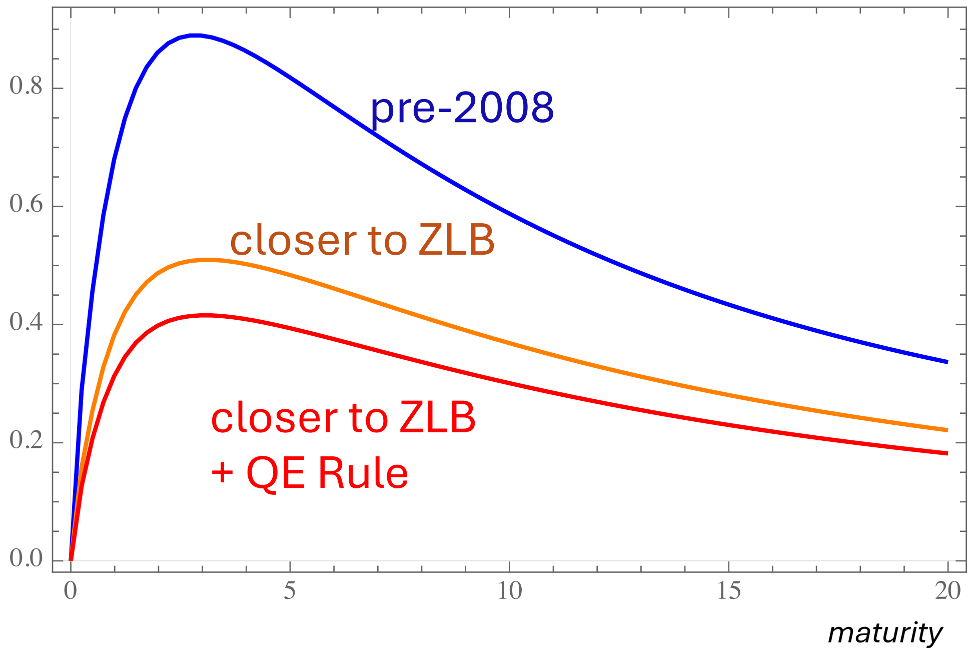

- Marginal effects of QE rule are small because
  - Rule kicks in 1/3 as often.
  - Rule kicks in when it is least effective.

Does the HMM rule capture the right *qualitative* behavior?

$$qe_t = \frac{1}{3} s_t$$

- This is definitely ***not*** the rule the Fed uses.
  - Generous interpretation: approximates more-complicated rule that stabilizes bond prices.

- But why would we expect QE to stabilize bond prices?
  - Fed buys bonds in recessions when rates are going down.
  - Fed sheds bonds in expansions when rates are going up.
  - This should ***amplify*** bond volatility, not reduce it.

- Authors consider alternative:

$$qe_t = -\mathbf{10}\, \boldsymbol{r_t} + \frac{1}{3} s_t$$

  - This is more realistic.
  - Causes all their results to go the other way.

Summing up

- The idea of a QE rule makes sense and should be studied further.

- But the HMM evidence can be explained ***without*** such a rule.
  - Endogenous effects of the ZLB are enough.

- And, when the rule is adjusted to be more realistic and take account of the ZLB, it has ***small effects*** that likely ***increase*** bond volatility.