Yield-Curve Control Policy under Inelastic Financial Markets

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This paper

A quantitative macroeconomic framework that incorporates

1. The general equilibrium term-structure of interest rates when financial markets are inelastic with imperfect substitutability

   — Estimation of the cross-elasticity of portfolio rebalancing across maturities

2. Multiple asset classes (government bonds and private bond) with time-varying, countercyclical term premia
3. Endogenous portfolio rebalancing among different kinds of assets
4. Government and central bank's explicit balance sheets
5. A micro-founded welfare criterion with ZLB constraints

which are necessary for quantitative policy experiments (e.g., conventional vs. unconventional monetary policies)

- Focus on yield-curve-control (YCC) policy as a baseline unconventional monetary policy, but the framework can be applied to other unconventional monetary policies as well.

Simple model: the core mechanism

For simplicity, let us assume two bonds only ($f = 1, 2$), rigid prices (no inflation dynamics), no loans to firms, no explicit balance-sheet sizes

Euler equation: the effective savings rate $\hat{r}^S_{t+1}$, not the policy rate $\hat{r}^1_{t+1}$, governs aggregate consumption demand

$$\hat{c}_t = \mathbb{E}_t \left[\hat{c}_{t+1} - \hat{r}^S_{t+1} \right]$$

portfolio return

where

$$\hat{r}^S_{t+1} = \sum_{f=1}^{2} \frac{\lambda^f R^f}{R^S} \left(\hat{\lambda}^f_t + \hat{r}^f_{t+1} \right)$$

portfolio share

Finite elasticity of portfolio rebalancing across maturities:

$$\hat{\lambda}^1_t = \kappa_B \, \mathbb{E}_t \left[\hat{r}^1_{t+1} - \hat{r}^2_{t+1} \right]$$

- Finite κ_B: changes in relative returns move portfolio shares, but not too much
- Conventional policy moves mainly $\hat{r}^1_{t+1} \Longrightarrow$ households rebalance along the yield curve

Simple model: conventional policy

Conventional policy: central bank moves the short rate Only

$$\hat{r}^1_{t+1} = \phi_C \hat{c}_t + \varepsilon_t, \qquad \hat{r}^2_{t+1} = 0$$

- For simplicity, the long-term rate is fixed now ($\hat{r}^2_{t+1} = 0$). In our quantitative model, there is an incomplete pass-through from the policy rate to the long-term rate.

The effective savings rate under conventional policy is given by:

$$\hat{r}^S_{t+1} = \underbrace{\eta_1}_{\substack{\text{Direct pass-through} \\ (\eta_1 < 1)}} \hat{r}^1_{t+1} - \underbrace{\eta_2}_{\substack{\text{Composition} \\ (\eta_2 > 0)}} \hat{\lambda}^1_t$$

- Tightening shocks $\varepsilon_t > 0$ lead to $\hat{\lambda}^1_t > 0$, decreasing the effective savings rate $\hat{r}^S_{t+1}$. This effect attenuates the policy-rate channel. $\hat{\lambda}^1_t > 0$ is determined by the elasticity κ_B.

- Portfolio rebalancing channel of monetary policy

Simple model: conventional policy

Combining the Euler equation, the Taylor rule, and portfolio demand:

$$\hat{c}_t^{\text{CP}} = -\frac{1}{1 + \underbrace{(\eta_1 - \eta_2\kappa_B)}_{\text{Effective monetary responsiveness}} \phi_C} \underbrace{(\eta_1 - \eta_2\kappa_B)}_{\text{Shock pass-through}} \varepsilon_t$$

- Portfolio rebalancing attenuates the policy effectiveness as well as the effective policy shock.
- If substitution is strong enough, conventional policy can even have the "wrong" sign

Simple model: why YCC is powerful

Yield-curve-control (YCC) policy: central bank moves both short and long rates following Taylor rules:

$$\hat{r}^1_{t+1} = \phi_C \hat{c}_t + \varepsilon_t, \qquad \mathbb{E}_t \hat{r}^2_{t+1} = \phi_{C,2} \hat{c}_t$$

Shock pass-through (Same)

With this, aggregate consumption demand is given by:

$$\hat{c}_t^{\text{YCC}} = -\frac{(\eta_1 - \eta_2 \kappa_B)\ \varepsilon_t}{1 + \underbrace{(\eta_1 \phi_C + (1-\eta_1)\phi_{C,2})}_{\text{Policy response}} - \eta_2 \kappa_B \underbrace{(\phi_C - \phi_{C,2})}_{\text{Cross-substitution}}}$$

Two forces (YCC)

1. Cross-substitution: if $\phi_{C,2}$ moves with ϕ_C, households have less incentive to rebalance across maturities
2. Policy response: the entire yield curve reacts to macroeconomic conditions

—YCC targets the exact margin through which conventional policy loses traction

What we do + findings

Takeaway (Conventional vs. YCC)

Yield-curve control (YCC) is powerful in terms of stabilization in both normal and ZLB

- Other unconventional monetary policies are effective—for example, central bank's direct purchases of private loans is effective[a]
- Sometimes, YCC generates a longer ZLB duration

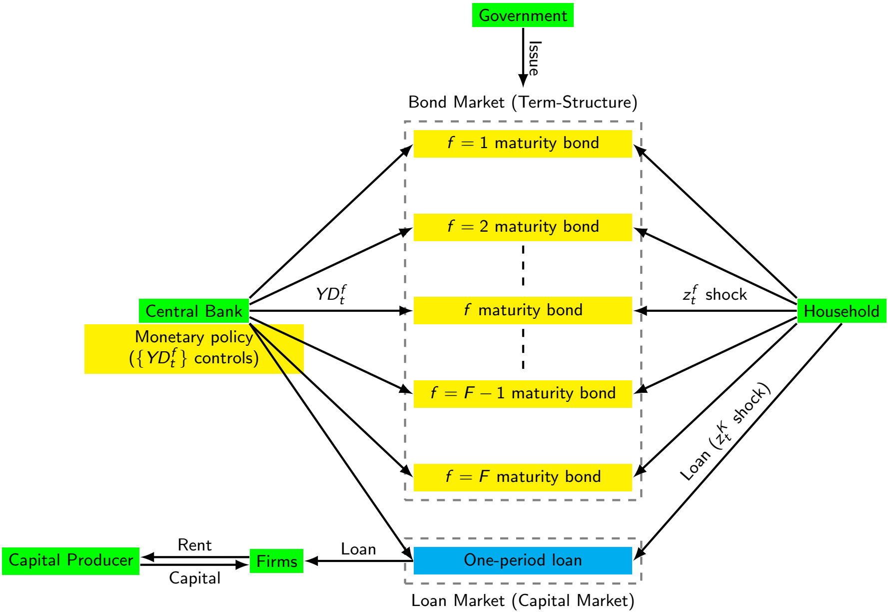
[a] The Fed's Primary and Secondary Market Corporate Credit Facilities in 2020 (Boyarchenko et al., 2022)

Potential mechanism: long term yields$\downarrow \Longrightarrow$ portfolio shares of short bonds and loans$\uparrow \Longrightarrow$ short yields and loan rates$\downarrow$ (disinflationary for firms) $\Longrightarrow$ ZLB duration$\uparrow$

- Still, YCC is very effective in terms of stabilization, offsetting this channel and reducing the ZLB duration on average.

Literature

The model: environment



The model: household

The representative household's problem (given B_0):

$$\max_{\{C_{t+j}, N_{t+j}\}} \mathbb{E}_t \sum_{j=0}^{\infty} \beta^j \left[\log\left(C_{t+j}\right) - \left(\frac{\eta}{\eta+1}\right) \left(\frac{N_{t+j}}{\bar{N}_{t+j}}\right)^{1+\frac{1}{\eta}} \right]$$

subject to

Loans *f*-maturity rate Loan rate

$$C_t + \frac{L_t}{P_t} + \frac{\sum_{f=1}^{F} B_t^{H,f}}{P_t} = \frac{\sum_{f=0}^{F-1} R_t^f B_{t-1}^{H,f+1}}{P_t} + \frac{R_t^K L_{t-1}}{P_t} + \int_0^1 \frac{W_t(\nu) N_t(\nu)}{P_t} \, d\nu + \frac{\Lambda_t}{P_t}$$

Nominal bond purchase
(*f*-maturity)

where

- ν: intermediate firm index such that:

$$N_t = \left(\int_0^1 N_t(\nu)^{\frac{\eta+1}{\eta}} \, d\nu \right)^{\frac{\eta}{\eta+1}}$$

- Q_t^f is the nominal price of *f*-maturity bond with:

$$(\text{Return})\ R_t^f = \frac{Q_t^f}{Q_{t-1}^{f+1}}, \quad (\text{Yield})\ YD_t^f = \left(\frac{1}{Q_t^f}\right)^{\frac{1}{f}}$$

The model: household and savings

Total savings: $S_t = B_t^H + L_t = \sum_{f=1}^{F} B_t^{H,f} + L_t$

Usual bond allocation problem (Ricardian):

$$\max \sum_{f=1}^{F} \mathbb{E}_t \left[Q_{t,t+1} R_{t+1}^{f-1} B_t^{H,f} \right] \quad \text{s.t.} \quad \sum_{f=1}^{F} B_t^{H,f} = B_t^H, \quad B_t^{H,f} \geq 0$$

which gives (in equilibrium):

$$\mathbb{E}_t \left[Q_{t,t+1} R_{t+1}^{f-1} \right] = \mathbb{E}_t \left[Q_{t,t+1} R_{t+1}^{0} \right], \quad \forall f \quad \Longrightarrow \quad \boxed{\mathbb{E}_t[\widehat{R}_{t+1}^{f-1}] = \widehat{R}_{t+1}^{0}}$$

'Expectations hypothesis'

Our approach (Non-Ricardian):

- Split the household into a family $m \in [0,1]$, each of which decides whether to invest in bonds or loan, subject to expectation shock $\sim$ Fréchet
- A bond family m is split into members $n \in [0,1]$, each of whom decides maturity f to invest in, subject to expectation shock $\sim$ Fréchet

Bond portfolio (e.g., Eaton and Kortum (2002))

$$\lambda_t^{HB,f} \equiv \left(\frac{z_t^f \; \mathbb{E}_t \left[Q_{t,t+1} R_{t+1}^{f-1} \right]}{\Phi_t^B} \right)^{\kappa_B}$$

Portfolio preference shock

where

f-maturity share

$$\Phi_t^B \equiv \left[\sum_{j=1}^{F} \left(z_t^j \, \mathbb{E}_t [Q_{t,t+1} R_{t+1}^{j-1}] \right)^{\kappa_B} \right]^{\frac{1}{\kappa_B}}$$

- Deviate from expectation hypothesis $\Longrightarrow$ $\exists$downward-sloping demand curve after log-linearization with finite demand elasticity and cross-elasticities
- Shape parameter κ_B: (inverse of) a degree of bonds market segmentation
- $z_t^f = 1$, $\kappa_B \to \infty$, then again expectations hypothesis (i.e., Ricardian)

Effective bond market rates

$$R_{t+1}^{HB} = \sum_{f=0}^{F-1} \lambda_t^{HB,f+1} R_{t+1}^f$$

Microfoundation (bond)

Loan share (e.g., Eaton and Kortum (2002))

Portfolio preference shock

$$\lambda_t^K = \left(\frac{z_t^K \; \mathbb{E}_t \left[Q_{t,t+1} R_{t+1}^K \right]}{\Phi_t^S} \right)^{\kappa_S}$$

Loan share

where

$$\Phi_t^S = \left[\left(\mathbb{E}_t [Q_{t,t+1} R_{t+1}^{HB}] \right)^{\kappa_S} + \left(z_t^K \mathbb{E}_t [Q_{t,t+1} R_{t+1}^K] \right)^{\kappa_S} \right]^{\frac{1}{\kappa_S}}$$

- $\exists$downward-sloping demand curve after log-linearization (for bonds and private loan) with finite demand elasticity and cross-elasticities
- Shape parameter κ_S: (inverse of) a degree of market segmentation between government bonds vs loan

Effective savings rate: governs intertemporal substitution

$$\begin{aligned} R_t^S &= \left(1 - \lambda_{t-1}^K\right) R_t^{HB} + \lambda_{t-1}^K R_t^K \\ &= \left(1 - \lambda_{t-1}^K\right) \sum_{f=0}^{F-1} \lambda_{t-1}^{HB,f+1} R_t^f + \lambda_{t-1}^K R_t^K \end{aligned}$$

Enters Euler equation

Microfoundation (loan)

Equilibrium + market clearing

Bond market equilibrium:

$$B_t^{H,f} + B_t^{G,f} + B_t^{CB,f} = 0, \quad \forall f = 1, \ldots, F$$

Monetary policy

Capital Producer, Firms, and Government

Central bank: monetary policy through balance sheet adjustments

- Conventional: Taylor rules on YD_t^1 (only adjusting $B_t^{CB,1}$)—still, $B_t^{CB,f}$ for $f > 1$ are subject to a quantity shock $u_t^{CB,f}$
- Yield-curve-control (YCC): Taylor rules on $\left\{YD_t^f\right\}$ $\left(\text{adjusting } \left\{B_t^{CB,f}\right\}\right)$
- The central bank holds corporate loans L_t^{CB}, which is subject to a quantity shock u_t^L
- Subject to zero lower bound (ZLB)

Conventional Unconventional

Steady-state U.S. calibrated yield curve (up to 30 years)

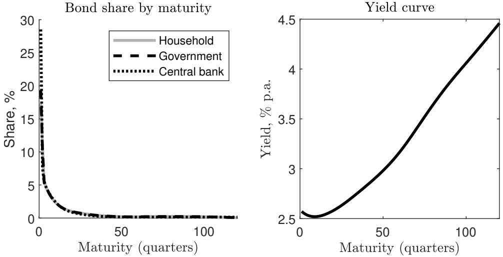


Figure: Steady-state bond portfolios of households, government, and central bank and the resultant yield curve (December 2002 - June 2007)

Estimation: $\kappa_B = 10$ from the aggregate bond portfolio data

▶▶ Estimation

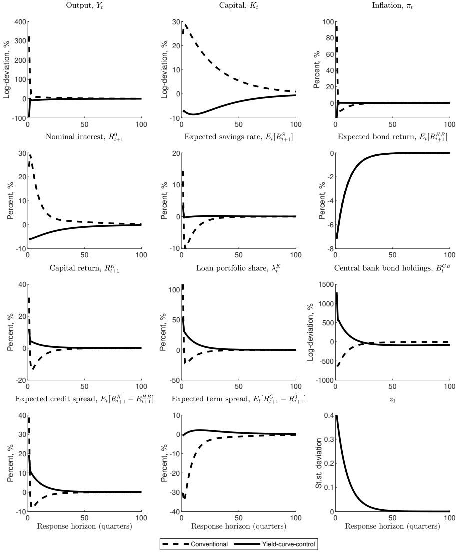
Calibration: given $\kappa_B = 10$ and $\kappa_S = 6$:

- $\{z^f\}_{f=1}^F$ (i.e., maturity preference for a maturity-f) $\Longrightarrow$ yield curve slopes
- z^K (i.e., preference for private loan) $\Longrightarrow$ the yield curve level
- Result: $z^1 = 1 >> z^f$ for $f \geq 2$ (e.g., safety - liquidity premium)

▶▶ Supply effects ▶▶ Demand effects ▶▶ Deficit ratio

Short-run analysis (Impulse-responses)

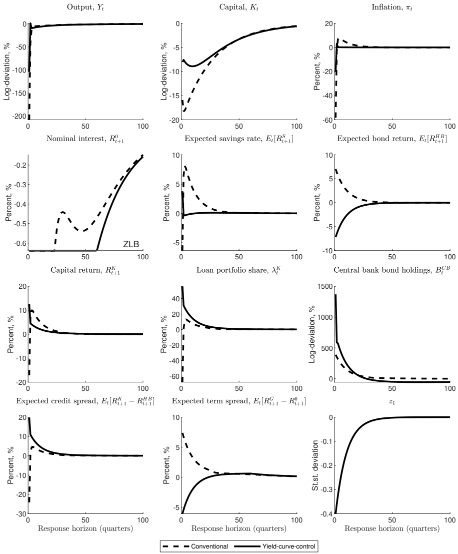
A shock to the preference for the short-term bond (impulse response to z_t^1)



Countercyclical term premia

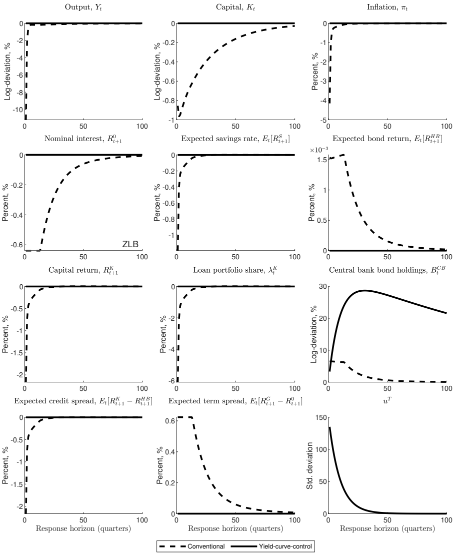
- YCC is almost perfectly stabilizing (filling gaps in bond demand)

ZLB impulse response to z_t^1



YCC still is powerful, but duration of ZLB episodes↑ in this case

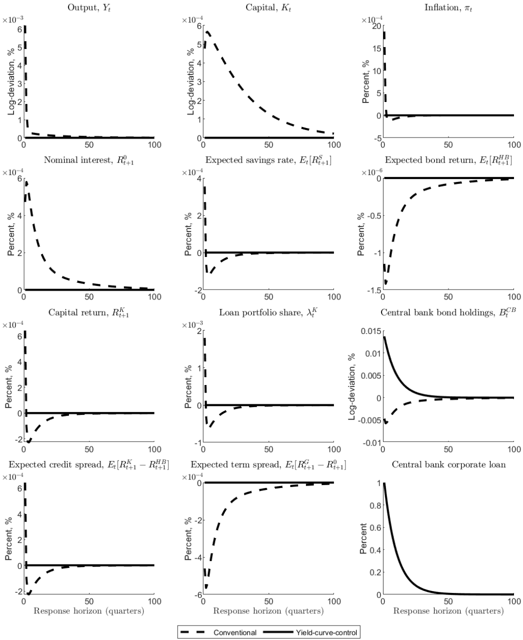
ZLB impulse response to an exogenous tax hike



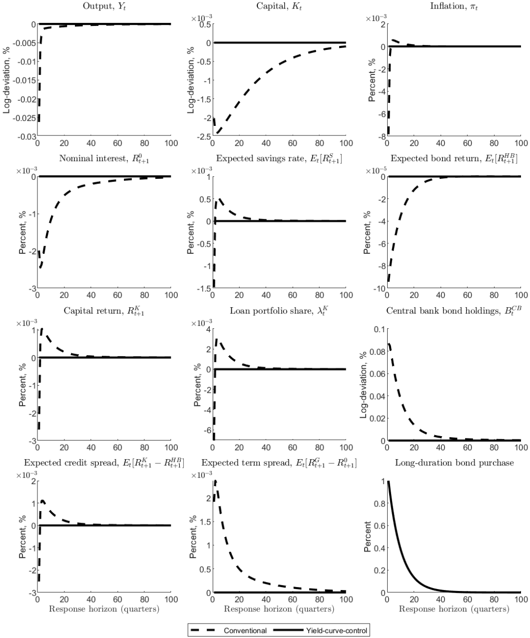
With conventional policy: non-Ricardian (tax↑ $\Longrightarrow$ bond supply↓)

Normal IRF (tax)

A shock to the central bank's holdings of loans u_t^L



A shock to the central bank's holdings of long bonds $u_t^{CB,f}$, $f = 20$



Policy comparison (Conventional, Yield-Curve-Control, and Mixed)

We also consider:

- Mixed policy: central bank starts controlling long-term rates only when FFR hits ZLB, thus YCC only at the ZLB

	Conventional	**Yield-Curve-Control**	**Mixed Policy**
Mean ZLB duration	4.425 quarters	2.375 quarters	2.9402 quarters
Median ZLB duration	2 quarters	2 quarters	1 quarters
ZLB frequency	14.303%	0.19192%	8.9394%
Welfare	−1.3425%	−0.99039%	−1.4067%

Table: Policy comparisons (ex-ante)

ZLB duration: YCC $<$ Mixed $<$ Conventional

ZLB frequency: YCC $<$ Mixed $<$ Conventional

Welfare: Mixed $<$ Conventional $<$ YCC

Thank you very much!
(Appendix)

Key previous works (only a few among many) Go back

- The term-structure and macroeconomy: Ang and Piazzesi (2003), Rudebush and Wu (2008), Bekaert et al. (2010)
- Central bank's endogenous balance sheet size as an another form of monetary policy: Gertler and Karadi (2011), Cúrdia and Woodford (2011), Christensen and Krogstrup (2018, 2019), Karadi and Nakov (2021), Sims and Wu (2021)
- Time-varying term premia in a New Keynesian model without inelastic bond markets: Rudebusch and Swanson (2012), Buncic and Lentner (2016), Kliem and Meyer-Gohde (2022), Mertens and Zhang (2025), Gurkaynak and Wright (2012)
- ZLB and the supply of safe bonds: Swanson and Williams (2014), Caballero and Farhi (2017), Caballero et al. (2021), Li and Merkel (2025),
- Preferred-habitat term-structure (and limited risk-bearing): Greenwood et al. (2020), Vayanos and Vila (2021), Ray (2019), Droste, Gorodnichenko, and Ray (2021), Gourinchas et al. (2021), Kekre et al. (2023)
- Cross-elasticity and portfolio rebalancing: Alpanda and Kabaca (2020), Jansen et al. (2025)

Our paper: General equilibrium term-structure under inelastic financial markets + balance sheet quantities of the government and central bank + yield-curve control (YCC) + novel ways to generate and estimate market segmentation

Bond family m: a member n has the following expectation shock:

$$\mathbb{E}_{m,n,t}\left[Q_{t,t+1}R_{t+1}^{f-1}\right] = z_{n,t}^{f} \cdot \mathbb{E}_t\left[Q_{t,t+1}R_{t+1}^{f-1}\right], \quad \forall f = 1, \ldots, F$$

with $z_{n,t}^{f}$ follows a Fréchet distribution with location parameter 0, scale parameter z_t^f, and shape parameter κ_B

Aggregation (Eaton and Kortum (2002))

$$\lambda_t^{HB,f} \equiv \mathbb{P}\left(\mathbb{E}_{m,n,t}\left[Q_{t,t+1}R_{t+1}^{f-1}\right] = \max_j\left\{\mathbb{E}_{m,n,t}\left[Q_{t,t+1}R_{t+1}^{j-1}\right]\right\}\right)$$

$$= \left(\frac{z_t^f \mathbb{E}_t\left[Q_{t,t+1}R_{t+1}^{f-1}\right]}{\Phi_t^B}\right)^{\kappa_B}$$

f-maturity share

- Deviate from expectation hypothesis $\Longrightarrow$ $\exists$downward-sloping demand curve after log-linearization with finite demand elasticity and cross-elasticities
- Shape parameter κ_B: (inverse of) a degree of bonds market segmentation

Effective bond market rates

$$R_{t+1}^{HB} = \sum_{f=0}^{F-1} \lambda_t^{HB,f+1} R_{t+1}^{f}$$

Go back

Loan vs. bond decision: a family m solves the following problem

$$\max \mathbb{E}_t \left[Q_{t,t+1} R^{HB}_{t+1} B^H_{m,t} \right] + z^K_{m,t} \cdot \mathbb{E}_t \left[Q_{t,t+1} R^K_{t+1} L_{m,t} \right] \quad \text{s.t.}$$
$$B^H_{m,t} + L_{m,t} = S_t, \quad B^H_{m,t} \geq 0, \quad \text{and} \quad L_{m,t} \geq 0$$

with $z^K_{m,t}$ follows a Fréchet distribution with location parameter 0, scale parameter z^K_t, and shape parameter κ_S

Aggregation (Eaton and Kortum (2002))

$$\lambda^K_t = \left(\frac{z^K_t \mathbb{E}_t \left[Q_{t,t+1} R^K_{t+1} \right]}{\Phi^S_t} \right)^{\kappa_S}$$

Loan share

- $\exists$downward-sloping demand curve after log-linearization (for bonds and private loan) with finite demand elasticity and cross-elasticities
- Shape parameter κ_S: (inverse of) a degree of market segmentation between government bonds vs loan

Effective savings rate: governs intertemporal substitution

$$R^S_t = \left(1 - \lambda^K_{t-1}\right) R^{HB}_t + \lambda^K_{t-1} R^K_t$$
$$= \left(1 - \lambda^K_{t-1}\right) \sum_{f=0}^{F-1} \lambda^{HB,f+1}_{t-1} R^f_t + \lambda^K_{t-1} R^K_t$$

Go back

Capital producer, firms, and government ⏩ Go back

Capital producer: lend capital to intermediate firms at price P_t^K (competitive)

Firms: standard with Cobb-Douglas production (pricing à la Calvo (1983))

- One financial friction: firms secure private loans from the household and the central bank to operate: for simplicity, borrow γ portion of the revenue it generates:

$$\underbrace{L_t(\nu)}_{\text{Loan of firm } \nu} \geq \gamma(1+\zeta^F)P_t(\nu)Y_t(\nu), \forall \nu$$

Government: with the following budget constraint

$$\frac{B_t^G}{P_t} = \frac{R_t^G B_{t-1}^G}{P_t} - \left[\underbrace{\zeta_t^G}_{\frac{G_t}{Y_t}\text{ (Exogenous)}} + \underbrace{\zeta^F}_{\text{Production subsidy}} - \underbrace{\zeta_t^T}_{\frac{T_t}{Y_t}\text{ (Exogenous)}} \right] Y_t, \quad R_t^G = \sum_{f=0}^{F-1} \underbrace{\lambda_{t-1}^{G,f+1}}_{\text{(Exogenous)}} R_t^f$$

- **Government**: a natural issuer of the entire bank market

Conventional monetary policy

Under the conventional monetary policy, central banks set Taylor rules on YD_t^1 while not manipulating longer term bonds holdings

- Long-term yields fluctuate endogenously (in response to shocks + changes in short-term rate)

$$R_{t+1}^0 \equiv YD_t^1 = \max\left\{ YD_t^{1*},\ 1 \right\}$$

ZLB

$$YD_t^{1*} = \overline{YD}^1 \left(\frac{YD_{t-1}^{1*}}{\overline{YD}^1} \right)^{\rho_1} \left(\frac{YD_{t-2}^{1*}}{\overline{YD}^1} \right)^{\rho_2} \left(\underbrace{\left(\frac{\Pi_t}{\bar{\Pi}} \right)^{\gamma_\pi^1} \left(\frac{Y_t}{\bar{Y}} \right)^{\gamma_y^1}}_{\text{Targeting}} \cdot \exp\left(\tilde{\varepsilon}_t^{YD^1} \right) \right)^{1-(\rho_1+\rho_2)}$$

MP shock ($f = 1$)

$$\underbrace{\frac{B_t^{CB,f}}{A_t \bar{N}_t P_t} = \frac{\overline{B^{CB,f}}}{A\bar{N}P} \exp\left(\tilde{u}_t^{CB,f} \right)}_{\text{Normalized holding of } f>1 \text{ fixed}} \quad \forall f = 2, \ldots, F$$

Quantity shock

Go back

Unconventional monetary policy: yield-curve-control (YCC)

In the unconventional monetary policy case, central bank targets all yields along the yield curve, assuming the Taylor-type rule for each maturity yield

- Back out the needed purchases of each maturity $\forall f$, which are endogenous

$$R^0_{t+1} \equiv YD^1_t = \max\left\{ YD^{1*}_t,\ \underbrace{1}_{\text{ZLB}} \right\}$$

$$YD^{1*}_t = \overline{YD}^1 \left(\frac{YD^{1*}_{t-1}}{\overline{YD}^1}\right)^{\rho_1} \left(\frac{YD^{1*}_{t-2}}{\overline{YD}^1}\right)^{\rho_2} \left(\underbrace{\left(\frac{\Pi_t}{\bar{\Pi}}\right)^{\gamma^1_\pi} \left(\frac{Y_t}{\bar{Y}}\right)^{\gamma^1_y}}_{\text{Targeting}} \cdot \exp\left(\underbrace{\tilde{\varepsilon}^{YD^1}_t}_{\text{MP shock } (f=1)} \right) \right)^{1-(\rho_1+\rho_2)}$$

$$YD^{f*}_t = \overline{YD}^f \left(\frac{YD^{f*}_{t-1}}{\overline{YD}^f}\right)^{\rho_1} \left(\frac{YD^{f*}_{t-2}}{\overline{YD}^f}\right)^{\rho_2} \left(\underbrace{\left(\frac{\Pi_t}{\bar{\Pi}}\right)^{\gamma^f_\pi} \left(\frac{Y_t}{\bar{Y}}\right)^{\gamma^f_y}}_{\text{Targeting}} \cdot \exp\left(\underbrace{\tilde{\varepsilon}^{YD^f}_t}_{\text{MP shock } (\forall f \geq 2)} \right) \right)^{1-(\rho_1+\rho_2)}$$

Go back

Central bank's corporate loan policy

The central bank sets its corporate loan holdings L_t^{CB}—the loan rate R_t^K adjusts endogenously to clear the loan market:

$$\frac{L_t^{CB}}{A_t \bar{N}_t P_t} = \overline{\left(\frac{L^{CB}}{A\bar{N}P}\right)} \cdot \exp\left(u_t^L \right),$$

Quantity shock
(corporate loans)

Go back

Estimation of κ_B

From portfolio equations:

$$\lambda_t^{HB,f} = \left(\frac{z_t^f \mathbb{E}_t \left[Q_{t,t+1} R_{t+1}^{f-1} \right]}{\Phi_t^B} \right)^{\kappa_B}$$

leading to:

f-maturity share

$$\log\left(\lambda_t^{H,f}\right) - \log\left(\lambda_t^{H,l}\right) = \alpha^{fl} + \kappa_B \cdot \mathbb{E}_t \left[r_{t+1}^{f-1} - r_{t+1}^{l-1} \right] + \varepsilon_t^{fl} \tag{1}$$

Local projection à la Jordà (2005):

$$\log\left(\lambda_{t+h}^{H,f}\right) - \log\left(\lambda_{t+h}^{H,l}\right) = \alpha_h^{fl} + \kappa_{B,h} \cdot \left[yd_t^f - yd_t^l \right] + \mathbf{x_t}' \beta_h^{fl} + \varepsilon_{t+h}^{fl}, \;\; h \geq 0$$

- Long maturity: $f = 5 \sim 10$ years and short: $l = 15 \sim 90$ days (bunching) for portfolio shares and use $f = 7$ years and $l = 3$ month for yields
- Control variables (e.g., lagged $\log\left(\lambda_{t-1}^{H,f}\right) - \log\left(\lambda_{t-1}^{H,l}\right)$ for seriel correlation)

Go back

Local projection à la Jordà (2005):

$$\log\left(\lambda^{H,f}_{t+h}\right) - \log\left(\lambda^{H,l}_{t+h}\right) = \alpha^{fl}_h + \kappa_{B,h} \cdot \left[yd^f_t - yd^l_t\right] + \mathbf{x_t}'\beta^{fl}_h + \varepsilon^{fl}_{t+h}, \;\; h \geq 0$$

Instrument for the yield spread $yd^f_t - yd^l_t$:

- Lagged yield spread $yd^f_{t-1} - yd^l_{t-1}$ ($\perp$ demand shocks, e.g., z^f_t, z^l_t)

- Instrument with the Treasury supply shocks of Phillot (2025), which are identified from high-frequency movements in Treasury futures prices around auction announcements.

Go back

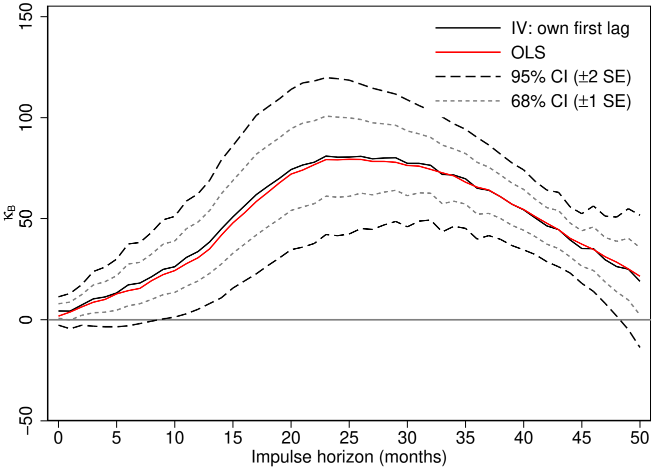


Figure: Impulse-Response to the yield spread $yd_t^f - yd_t^l$, instrumented with the lagged yield spread $yd_{t-1}^f - yd_{t-1}^l$. The sample period is from 2003m3 to 2019m3.

Go back

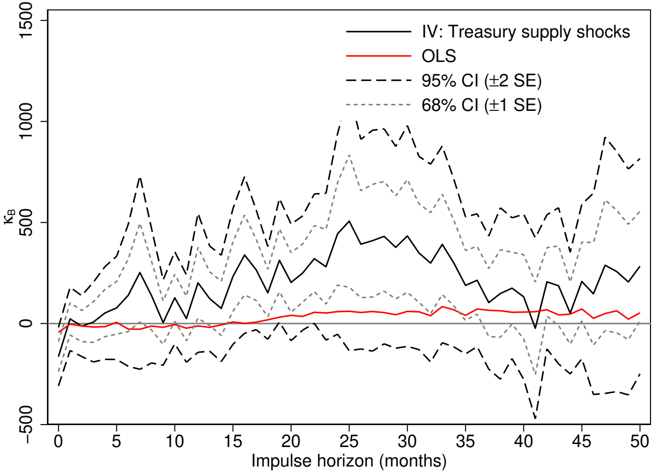


Figure: Impulse-Response to the yield spread $yd_t^f - yd_t^l$, instrumented with Phillot (2025)'s 5- and 10-year Treasury supply shocks. The sample period is from 2003m3 to 2019m3.

Go back

Government's bond supply effects

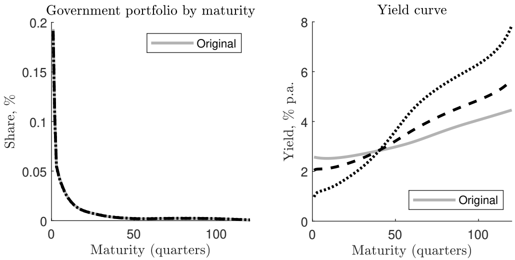


Figure: Government's bond issuance portfolio and yield curve

- Government's supply of f-maturity bond$\uparrow$ $\Longrightarrow$ its yield$\uparrow$ (i.e., price effect)
- Similar to Krishnamurthy and Vissing-Jorgensen (2012) and Greenwood and Vayanos (2014) in the long run

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Central bank's bond demand effects

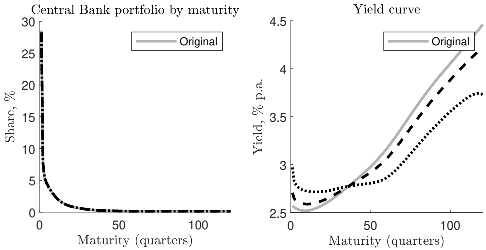

Figure: Central bank's bond demand portfolio and yield curve

- Inelastic markets $\Longrightarrow$ central bank's bond demand matters in the long run

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A deficit ratio: comparative statics

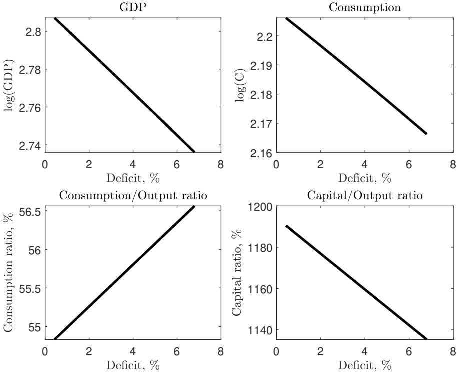

Figure: Variations in a deficit ratio $\zeta_t^G + \zeta^F - \zeta_t^T$

A higher deficit ratio $\Longrightarrow$ depressed economy (for $R^G \downarrow$)

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A deficit ratio: comparative statics

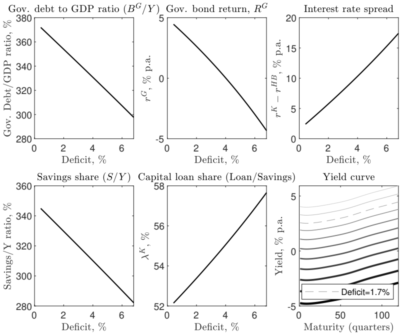

Figure: Variations in a deficit ratio $\zeta_t^G + \zeta^F - \zeta_t^T$

A higher deficit ratio $\Longrightarrow$ depressed economy (for $R^G\downarrow$)

- An entire yield curve$\downarrow$

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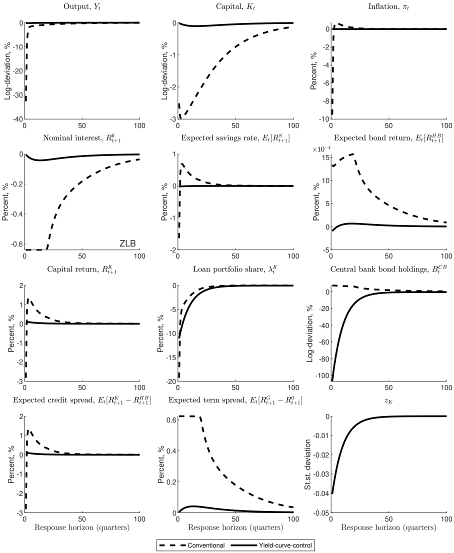
ZLB impulse response to z_t^K



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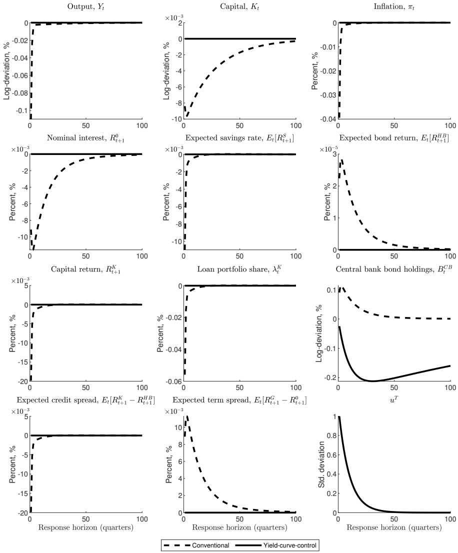
Impulse-response to an exogenous tax hike shock



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