

Asset purchase policy at the effective lower bound for interest rates

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- Introduction
- The model
- The policy problem
- Results
- Summary & conclusions



- Introduction
 - Motivation
 - Aims and scope
 - The key mechanism
 - Implications
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- 2008 recession particularly severe and synchronised
- Policy reactions
 - Sharp reductions in short-term policy rates
 - Significant expansions of central bank balance sheets
 - Fiscal expansions
- Central bank balance sheet expansions
 - Associated with 'unconventional' monetary policies
 - Short-term policy rates reached their lower bounds
- Paper investigates one aspect of one type of these policies



- Canonical New Keynesian (CNK) model:
 - Workhorse for monetary policy in recent years
 - Simplicity a virtue for delivering stark results
- CNK conventional wisdom at the lower bound:
 - Hold policy rate at lower bound for 'prolonged period'
 - Effects on output gap and inflation relatively small
- However:
 - Results sensitive to parameterisation (Levin et al (2009))
 - No role for asset purchase policies
- Paper makes minor modification to CNK model:
 - Simple, stylised and incremental
 - Long-term and short-term bonds are imperfect substitutes
 - Can then analyse role for asset purchase policies



- Households suffer 'discomfort' if their portfolios deviate from preferred mix of assets
- Interpret 'discomfort' as concern for liquidity
 - Long-bonds are, in some (unmodelled) way, less liquid
 - Holding more short-term bonds reduces marginal liquidity cost
- Households equate 'liquidity adjusted' rates of return
 - Relative rates of return depend on portfolio mix
 - Asset purchases can alter relative asset supplies ...
 - ... and hence bond yields ...
 - ... and hence aggregate demand



- ① Transmission mechanism of *conventional policy* weakened
 - Lowering policy rate reduces liquidity
 - Long rates fall by less than implied by expectations theory
 - Effective lower bound more of a constraint
- ② Welfare-based loss function changes
 - Deviations of portfolio mix from target generate welfare costs
 - Policy should stabilise portfolio mix, output gap and inflation
- ③ Asset purchases can help stabilise output and inflation, but:
 - Constrained by feasibility bounds
 - Should be at least partly directed towards stabilising portfolio



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- The model
 - Key elements
 - Households
 - Government budget constraint
 - Asset purchases
 - Fiscal policy
 - Supply
 - Parameter values
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The model: key elements

- Both long-term and short-term bonds circulate
 - Long-term bonds are consols: infinite maturity
 - Can express budget constraints in terms of one period returns
- Households have preferred portfolio mix
 - Preferences captured in utility function
 - Deviations from preferred mix reduce utility
- Preferred portfolio mix is exogenous
 - Assumed equal to government debt mix in steady-state
 - Bonds trade at same price in long run
- Adjustment costs arbitrary
 - Approximation to financial intermediation frictions?
 - Approximation to heterogeneity?



- Households solve the following problem

$$\max E_0 \sum_{t=0}^{\infty} \beta^t \phi_t \left[\begin{array}{l} \frac{c_t^{1-\sigma^{-1}}}{1-\sigma^{-1}} - \frac{n_t^{1+\psi}}{1+\psi} + \frac{\chi_m^{-1}}{1-\sigma_m^{-1}} \left(\frac{M_t}{P_t} \right)^{1-1/\sigma_m} \\ - \frac{\tilde{\nu}}{2} \left[\delta \frac{B_t}{B_{L,t}} - 1 \right]^2 \end{array} \right]$$

subject to

$$B_{L,t} + B_t + M_t = R_{L,t} B_{L,t-1} + R_{t-1} B_{t-1} + M_{t-1} + W_t n_t + T_t + D_t - P_t c_t$$

- Implies (log-linearised) no arbitrage relationship for bond returns:

$$\hat{R}_{L,t}^e = \hat{R}_t - \nu \left[\hat{b}_t - \hat{b}_{L,t} \right]$$

- Euler equation depends on both long and short rates
- ϕ is 'demand shock'



The model: government budget constraint

- Net debt issuance finances transfers to households

$$\frac{B_{L,t}^g}{P_t} + \frac{B_t}{P_t} - \frac{R_{L,t}B_{L,t-1}^g}{P_t} - \frac{R_{t-1}B_{t-1}}{P_t} + \frac{\Delta_t}{P_t} = \frac{T_t}{P_t}$$

- Written in terms of one period return on consol (B_c) that sells at price V :

$$B_{L,t}^g \equiv V_t B_{c,t}$$
$$R_{L,t} \equiv \frac{1 + V_t}{V_{t-1}}$$

- T are lump sum transfers to households
- Δ is change in the central bank balance sheet



The model: asset purchases

- Change in the central bank balance sheet:

$$\frac{\Delta_t}{P_t} = \frac{M_t - M_{t-1}}{P_t} - \left[\frac{Q_t}{P_t} - \frac{R_{L,t} Q_{t-1}}{P_t} \right]$$

- Q represents purchases of long-term bonds

$$Q_t = q_t B_{L,t}^g$$

- Long-term bond market clearing

$$B_{L,t} = (1 - q_t) B_{L,t}^g$$



- No government procurement or production
- *Consol* stock fixed in real terms

$$b_{L,t}^g = \bar{b}_C V_t$$

- Transfers adjusted to stabilise short-term debt stock
- Log-linearised transfer rule is

$$\frac{\tau}{b} \hat{\tau}_t = -\beta^{-1} \hat{R}_{t-1} - \theta \hat{b}_{t-1}$$

- Offsets direct impact of interest financing costs
- Mimics likely effect of active fiscal policy response to downturn



- Standard CNK assumptions
 - Firms monopolistically competitive
 - Labour is only factor of production
 - Calvo price stickiness mechanism
- Leads to conventional Phillips curve

$$\hat{\pi}_t = \kappa \hat{x}_t + \beta E_t \hat{\pi}_{t+1}$$



The model: parameter values

σ	Description	Value
σ	Elasticity of intertemporal substitution	6
β	Discount factor	0.9925
κ	Slope of Phillips curve	0.024
ρ	Autocorrelation of natural real interest rate	0.85
η	Elasticity of substitution in consumption bundle	5
σ_m	Money demand elasticity	6
α	Calvo probability of <i>not</i> changing price	0.75
ψ	Labour supply elasticity	0.11
δ	Steady state ratio of long-term bonds to short-term bonds	3
ν	Elasticity of long-term bond rate with respect to portfolio mix	0.09
θ	Feedback parameter in tax/transfer rule	0.01



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Policy problem: objective function

$$\mathcal{L} = \sum_{t=0}^{\infty} \beta^t \left[\hat{x}_t^2 + \frac{\eta}{\kappa} \hat{\pi}_t^2 + \frac{\nu}{(1+\delta)(\sigma^{-1} + \psi)} \frac{\bar{b}_L}{c} \left[\hat{b}_t - \hat{b}_{L,t} \right]^2 \right]$$

- Policy should stabilise mix of short-term and long-term bonds
- Reflects presence of adjustment costs in utility function
- Analyse policy from a 'timeless perspective'



Policy problem: constraints

$$\hat{x}_t = E_t \hat{x}_{t+1} - \sigma \left[\frac{1}{1+\delta} \hat{R}_t + \frac{\delta}{1+\delta} \hat{R}_{L,t}^e - E_t \hat{\pi}_{t+1} - r_t^* \right]$$

$$\hat{R}_t = \hat{R}_{L,t}^e + \nu \left[\hat{b}_t - \hat{b}_{L,t} \right]$$

$$\hat{\pi}_t = \beta E_t \hat{\pi}_{t+1} + \kappa \hat{x}_t$$

$$\hat{b}_t - \delta q_t = -\beta^{-1} (1 + \delta) \hat{\pi}_t + (\beta^{-1} - \theta) \hat{b}_{t-1} - \beta^{-1} \delta q_{t-1}$$

$$-q_t + \hat{V}_t = \hat{b}_{L,t}$$

$$\hat{R}_{L,t}^e = \beta E_t \hat{V}_{t+1} - \hat{V}_t$$

$$\hat{R}_t \geq \underline{R}$$

$$q_t \geq \underline{q}$$

$$q_t \leq \bar{q}$$



- Economy starts from steady state
 - Inflation at target (normalised to zero)
 - Output gap zero
- Very large and persistent fall in the natural real interest rate
 - Falls from 3% (steady-state level) to -3%
 - Unwinds with AR coefficient 0.85 (Levin et al (2009))
 - Interpreted as a large, long-lived negative demand shock
- Optimal response is to loosen policy to offset fall in demand
- But instruments are bounded
 - Lower bound on policy rate assumed to be 0.25%
 - Asset purchases bounded by $0 \leq q_t \leq 1$



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 - Ignoring bounds on instruments
 - The effects of asset purchases
 - Comparison with CNK model
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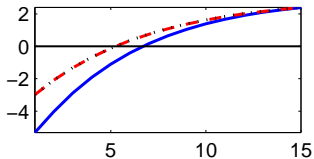
Results: ignoring bounds on instruments

- Useful thought experiment
- Implies that
 - Lower bound on policy rate more harmful than in CNK model
 - Constraints on asset purchases likely to bind



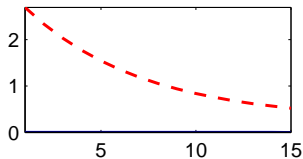
Results: ignoring bounds on instruments

Short rate and natural real rate (dotted)

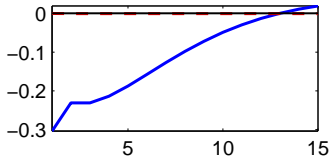


Five-year spot rate

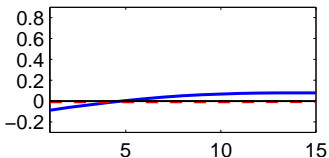
Asset purchases



Output gap



Annualised inflation





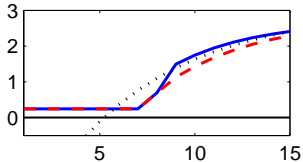
Results: the effects of asset purchases

- Compare cases in which lower bound on policy rate enforced
 - ① Only short-term policy rate can be used
 - ② Asset purchases allowed (subject to bounds)
- Asset purchases obviously improve outcomes
- Upper bound on purchases binds during loosening phase
- Lower bound binds during tightening phase

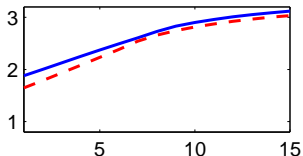


Results: the effects of asset purchases

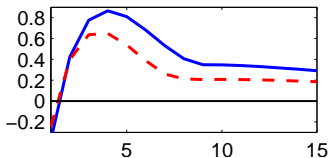
Short rate and natural real rate (dotted)



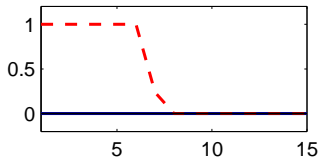
Five-year spot rate



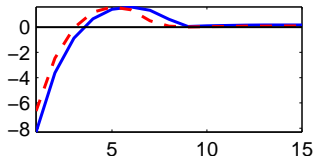
Annualised inflation



Asset purchases



Output gap





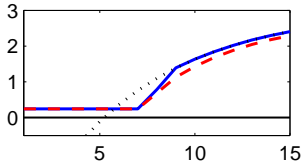
Results: comparison with CNK model

- Consider two cases
 - ① Policymaker uses welfare-based loss function
 - ② Policymaker uses CNK loss function
- Attempt to isolate effects of changes in
 - Structure of the economy from
 - Objective function
- For CNK loss function, asset purchase policies improve welfare *even though*
 - Effectiveness of conventional monetary policy reduced
 - Asset purchases are bounded

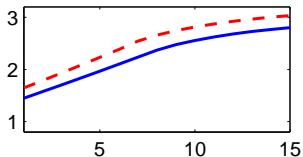


Results: comparison with CNK model (1)

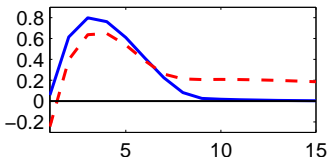
Short rate and natural real rate (dotted)



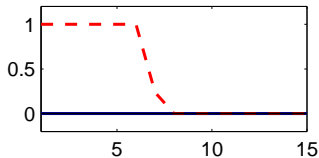
Five-year spot rate



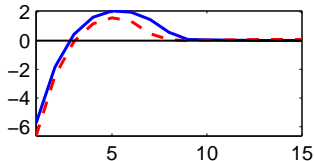
Annualised inflation



Asset purchases



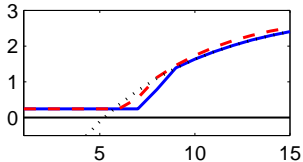
Output gap



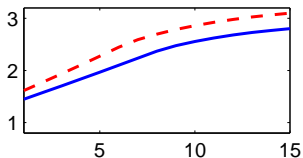


Results: comparison with CNK model (2)

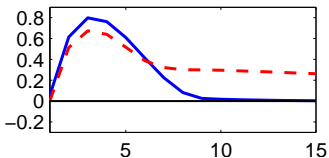
Short rate and natural real rate (dotted)



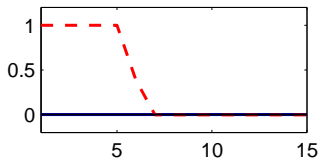
Five-year spot rate



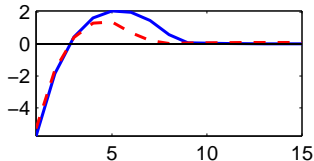
Annualised inflation



Asset purchases



Output gap





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- Make simple, stylised and incremental addition to CNK model
 - Long-term and short-term bonds are imperfect substitutes
 - Provides role for asset purchase policies
- Despite simplicity, there are several implications
 - 1 Transmission mechanism of conventional policy weakened
 - 2 Welfare-based loss function should stabilise portfolio mix, output gap and inflation
 - 3 Asset purchases can help stabilise output and inflation, even when bounded