Asset purchase policy at the effective lower bound for interest rates

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- The policy problem
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Motivation

- 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

Aims and scope

- 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

Key mechanism

- 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

Implications

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

- 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?

The model: households

- Households solve the following problem

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

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:

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

- 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

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

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

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

- 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

$$Q_t = q_t B^g_{L,t}$$

- Long-term bond market clearing

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

The model: fiscal policy

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

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

- 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

The model: supply

- 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

	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 *not* 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

$$
\begin{aligned}
\hat{x}_t &= E_t \hat{x}_{t+1} - \sigma \left[\frac{1}{1+\delta} \hat{R}_t + \frac{\delta}{1+\delta} \hat{R}^e_{L,t} - E_t \hat{\pi}_{t+1} - r^*_t \right] \\
\hat{R}_t &= \hat{R}^e_{L,t} + \nu \left[\hat{b}_t - \hat{b}_{L,t} \right] \\
\hat{\pi}_t &= \beta E_t \hat{\pi}_{t+1} + \kappa \hat{x}_t \\
\hat{b}_t - \delta q_t &= -\beta^{-1} (1+\delta) \hat{\pi}_t + \left(\beta^{-1} - \theta \right) \hat{b}_{t-1} - \beta^{-1} \delta q_{t-1} \\
-q_t + \hat{V}_t &= \hat{b}_{L,t} \\
\hat{R}^e_{L,t} &= \beta E_t \hat{V}_{t+1} - \hat{V}_t \\
\hat{R}_t &\geq \underline{R} \\
q_t &\geq \underline{q} \\
q_t &\leq \bar{q}
\end{aligned}
$$

Policy problem: the shock

- 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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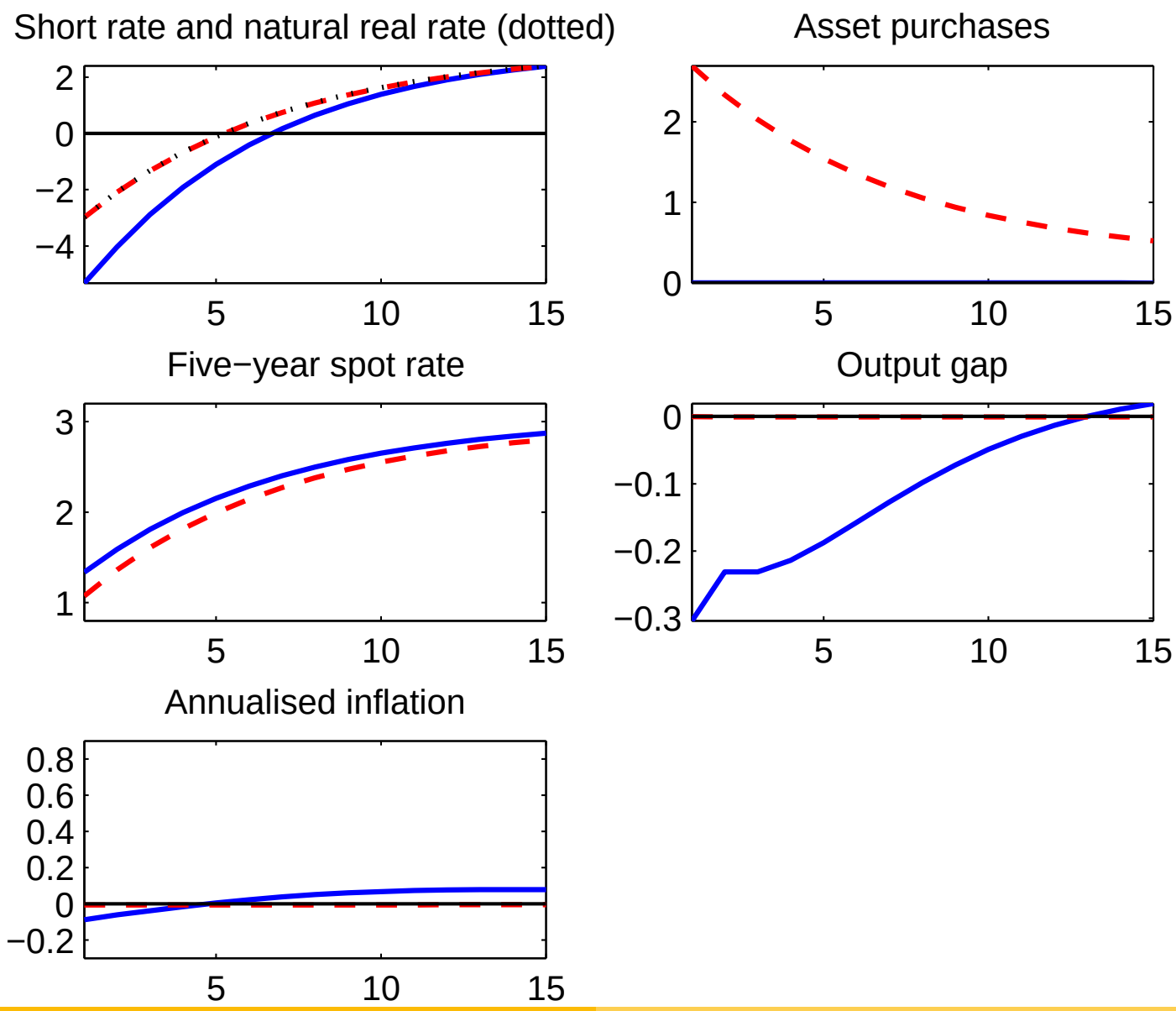
Results: ignoring bounds on instruments

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

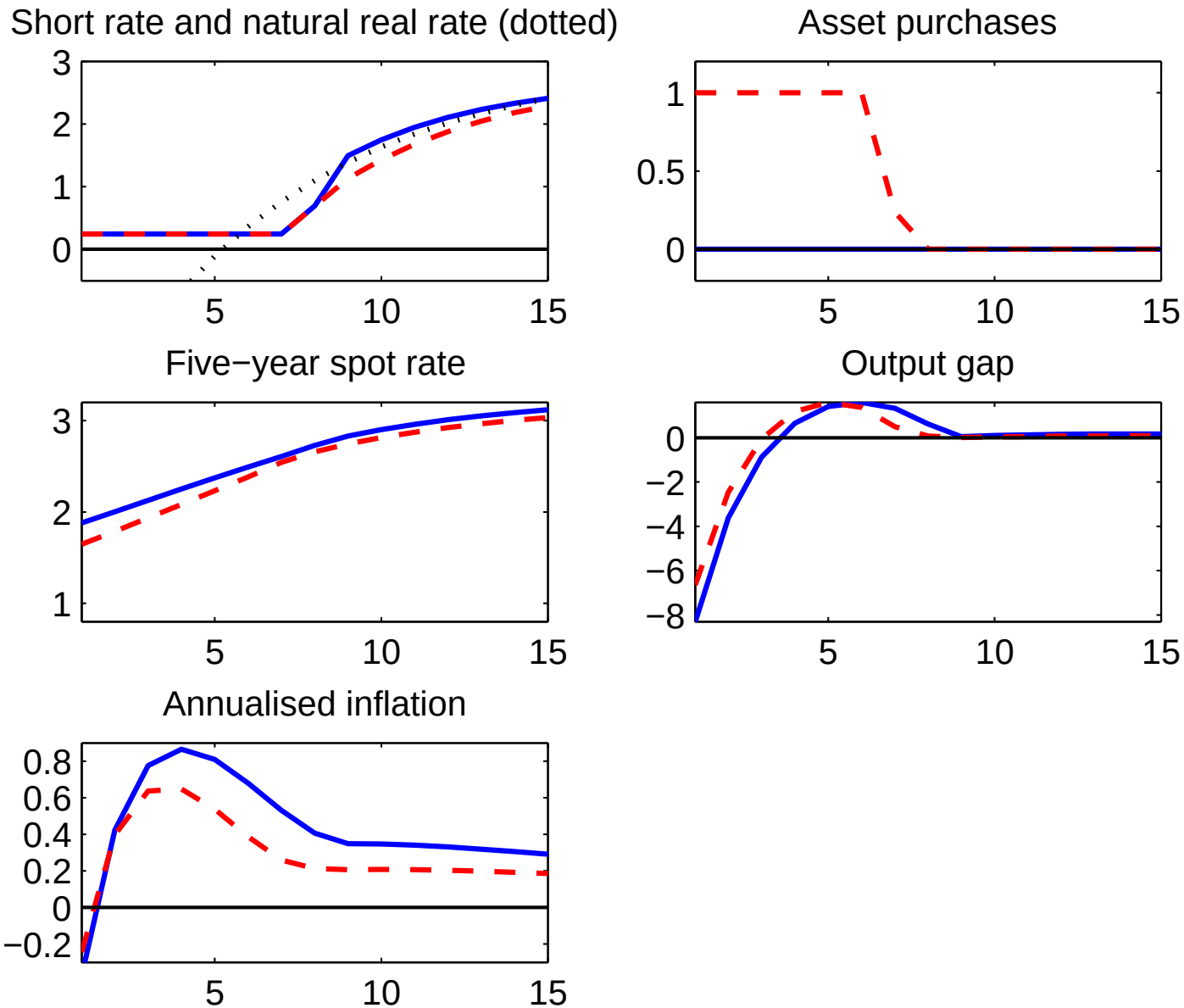
Results: ignoring bounds on instruments



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

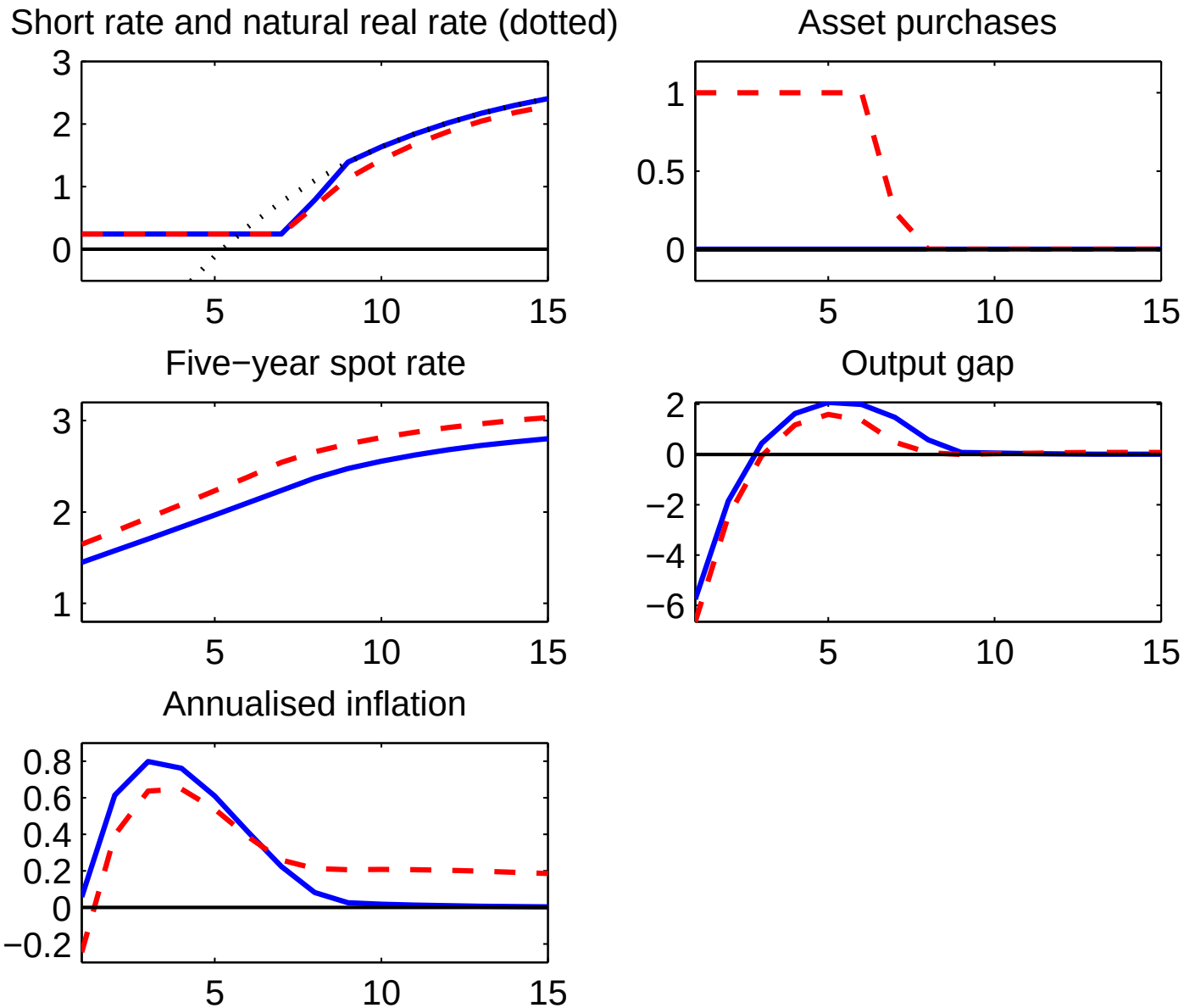
Results: the effects of asset purchases



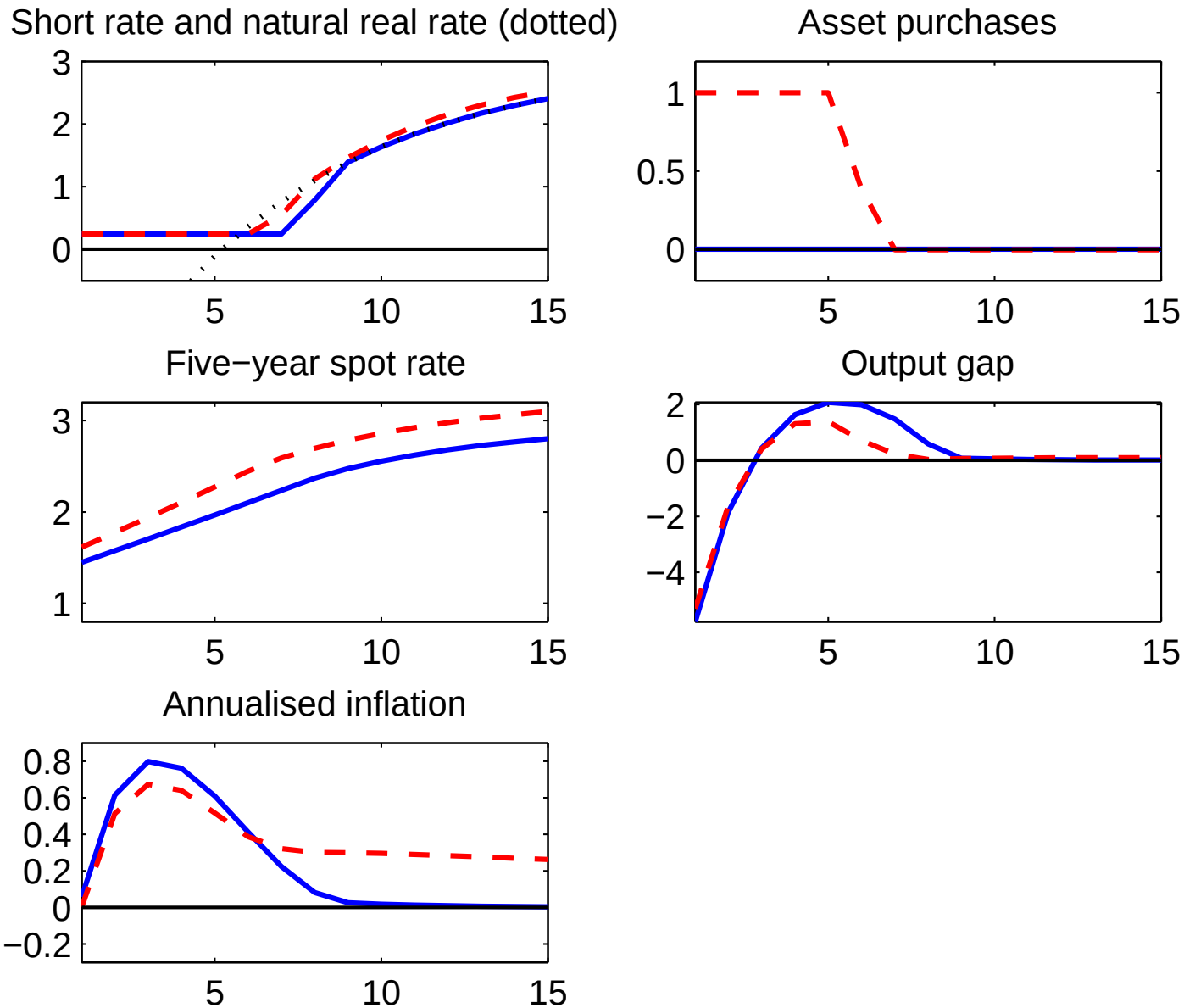
Results: comparison with CNK model

- 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)



Results: comparison with CNK model (2)



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Summary & conclusions

- 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 mechansim 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