Asset purchase policy at the effective lower bound for interest rates

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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
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
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

Welfare-based loss function changes

- Deviations of portfolio mix from target generate welfare costs
- Policy should stabilise portfolio mix, output gap and inflation

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

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

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

- \( \phi \) 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
• \(\Delta\) 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

$$B_{L,t} = (1 - q_t) B_{L,t}^g$$
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
  \[ \frac{\tau}{b} \hat{r}_t = -\beta^{-1} \hat{R}_{t-1} - \theta \hat{b}_{t-1} \]
- 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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\sigma$</td>
<td>Elasticity of intertemporal substitution</td>
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</tr>
<tr>
<td>$\beta$</td>
<td>Discount factor</td>
<td>0.9925</td>
</tr>
<tr>
<td>$\kappa$</td>
<td>Slope of Phillips curve</td>
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<tr>
<td>$\rho$</td>
<td>Autocorrelation of natural real interest rate</td>
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<tr>
<td>$\eta$</td>
<td>Elasticity of substitution in consumption bundle</td>
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</tr>
<tr>
<td>$\sigma_m$</td>
<td>Money demand elasticity</td>
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</tr>
<tr>
<td>$\alpha$</td>
<td>Calvo probability of <em>not</em> changing price</td>
<td>0.75</td>
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<tr>
<td>$\psi$</td>
<td>Labour supply elasticity</td>
<td>0.11</td>
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<tr>
<td>$\delta$</td>
<td>Steady state ratio of long-term bonds to short-term bonds</td>
<td>3</td>
</tr>
<tr>
<td>$\nu$</td>
<td>Elasticity of long-term bond rate with respect to portfolio mix</td>
<td>0.09</td>
</tr>
<tr>
<td>$\theta$</td>
<td>Feedback parameter in tax/transfer rule</td>
<td>0.01</td>
</tr>
</tbody>
</table>
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  - Constraints
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Policy problem: objective function

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

- 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

\[
\begin{align*}
\hat{x}_t &= E_t \hat{x}_{t+1} - \sigma \left[ \frac{1}{1 + \delta} \hat{R}_t + \frac{\delta}{1 + \delta} \hat{R}_{L,t} - E_t \hat{\pi}_{t+1} - r_t^* \right] \\
\hat{R}_t &= \hat{R}_{L,t} + \nu \left[ \hat{b}_t - \hat{b}_{L,t} \right] \\
\hat{\pi}_t &= \beta E_t \hat{\pi}_{t+1} + \kappa \hat{x}_t \\
\hat{b}_t - \delta q_t &= -\beta^{-1} (1 + \delta) \hat{\pi}_t + \left( \beta^{-1} - \theta \right) \hat{b}_{t-1} - \beta^{-1} \delta q_{t-1} \\
-q_t + \hat{V}_t &= \hat{b}_{L,t} \\
\hat{R}_{L,t} &= \beta E_t \hat{V}_{t+1} - \hat{V}_t \\
\hat{R}_t &\geq \bar{R} \\
q_t &\geq q \\
q_t &\leq \bar{q}
\end{align*}
\]
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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  • Ignoring bounds on instruments
  • The effects of asset purchases
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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

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Asset purchase policy
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

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Asset purchase policy
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)

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Asset purchase policy
Results: comparison with CNK model (2)

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Asset purchase policy
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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 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