

DISCUSSION:  
PEGGING THE INTEREST RATE ON BANK  
RESERVES:  
BY  
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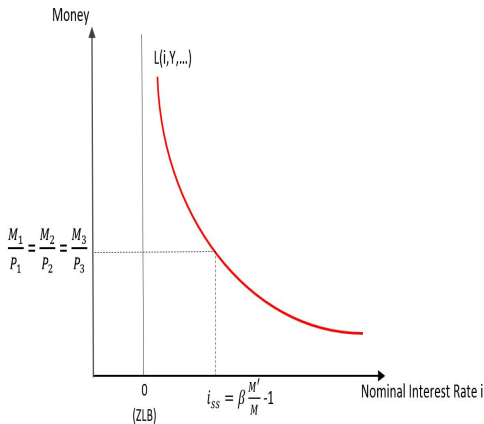
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Monetary Policy in Non-Standard Times  
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# OUTLINE

- Price Level Indeterminacy.
- Sargent and Wallace (1975) indeterminacy
  - overcome?
  - or does not apply?
- Obstfeld and Rogoff (1983):  
Hyperdeflations/Hyperinflations
- Why is Determinacy useful: Puzzle 1, Puzzle 2, ...
- Price Level Determinacy in  
**Heterogeneous Agent New Keynesian** models.
- Conclusion

# PRICE LEVEL INDETERMINACY



Real Interest Rate:

$$(1 + r) = \frac{1}{\beta}$$

Monetary Policy:

Sets  $1 + i$

Money

$M_1, M_2, M_3, \dots$

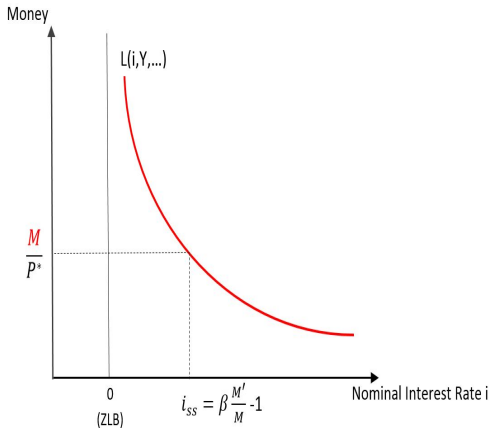
$$1 + \pi = \frac{M'}{M} = \beta(1 + i)$$

$i$  : nominal interest rate       $M$  : money stock

$r$  : real interest rate

$\pi$  : inflation rate

# PRICE LEVEL INDETERMINACY



$i$  : nominal interest rate  
 $r$  : real interest rate  
 $\pi$  : inflation rate

$M$  : money stock  
 $L$  : Real money demand

Real Interest Rate:

$$(1 + r) = \frac{1}{\beta}$$

Monetary Policy:

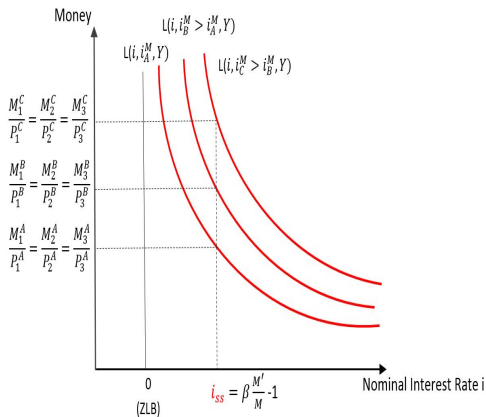
Sets  $M$  and  $\frac{M'}{M}$

Inflation / Interest Rates

$$1 + \pi = \frac{M'}{M}$$

$$1 + i = \frac{1 + \pi}{1 + r} = \beta \frac{M'}{M}$$

# PRICE LEVEL INDETERMINACY



Monetary Policy:

Sets  $1 + i$  and  $1 + i^M$

Money

$M_1, M_2, M_3, \dots$

$1 + \pi = \frac{M'}{M} = \beta(1 + i)$

$i$  : nominal interest rate

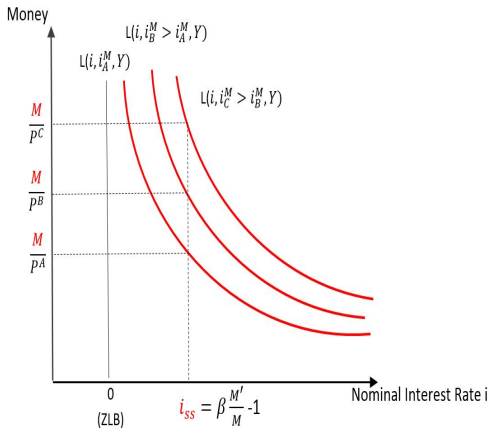
$M$  : money stock

$r$  : real interest rate

$i^M$  : nominal rate on  $M$

$\pi$  : inflation rate

# PRICE LEVEL INDETERMINACY: THIS PAPER



$i$  : nominal interest rate  
 $r$  : real interest rate  
 $\pi$  : inflation rate

$M$ : money stock  
 $i^M$  : nominal rate on  $M$

Real Interest Rate:

$$(1 + r) = \frac{1}{\beta}$$

Monetary Policy:

Sets  $M$ ,  $\frac{M'}{M}$  and  $i^M$

Inflation / Interest Rates

$$1 + \pi = \frac{M'}{M}$$

$$1 + i = \frac{1 + \pi}{1 + r} = \beta \frac{M'}{M}$$

## SUMMARY PRICE LEVEL DETERMINACY

- Central bank cannot set  $M$ ,  $i^M$  and  $i$
- Central bank can set  $M$  and  $i^M$ .
  - ↪ Equilibrium determines Bond return  $i$
- Setting money supply (with or without  $i^M$ ):
  - ↪ Price level determinate.

## SUMMARY PRICE LEVEL DETERMINACY

- Sargent and Wallace:

Pegging  $i$  (not  $M$  or  $i^M$ )  $\Rightarrow$  Price Level Indeterminacy

- Consensus (so far): CB controls return on bonds:

$\hookrightarrow$  Sargent and Wallace indeterminacy

- This paper:

Key what Central bank does

(not so much small model departure):

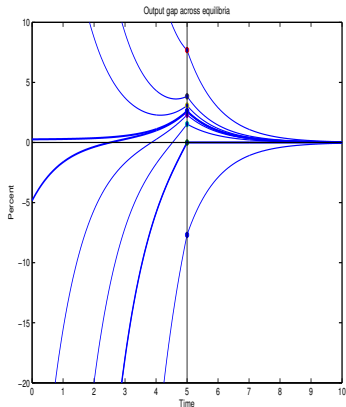
- Sets Money supply.
  - Does not control return on bonds.
  - Sets return on reserves/money (e.g. pegging  $i^M$ )
  - SW assumption not satisfied.
- Delivers Price Level Determinacy (unlike sticky info) but:  
CB loses control over intertemporal substitution margin.



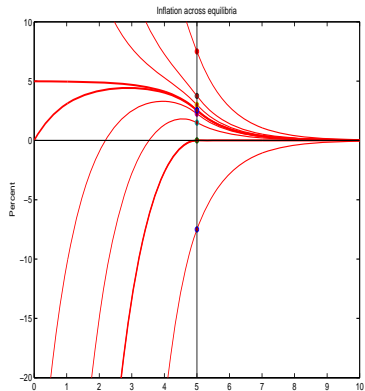
## OBSTFELD AND ROGOFF (1983)

- Obstfeld and Rogoff (1983): Even if  $M'/M$  finite  
Price level determinacy requires to
  - rule out hyperdeflations
  - rule out hyperinflations
- Hyperdeflations:  
Several possibilities, e.g. transversality condition.
- Hyperinflations:
  - Again several possibilities.
  - Obstfeld and Rogoff: Have to rule out that  $P$  jumps to  $\infty$ .
  - Difficult with flexible prices (money has to be essential).
  - Easy with the smallest amount of price stickiness (Calvo, Rotemberg).
- No satiation  $\rightarrow$  HANK.

# COCHRANE (2015)'S POLICY ANALYSIS OF NEW-KEYNESIAN MODELS DURING A LIQUIDITY TRAP.



(A) Output

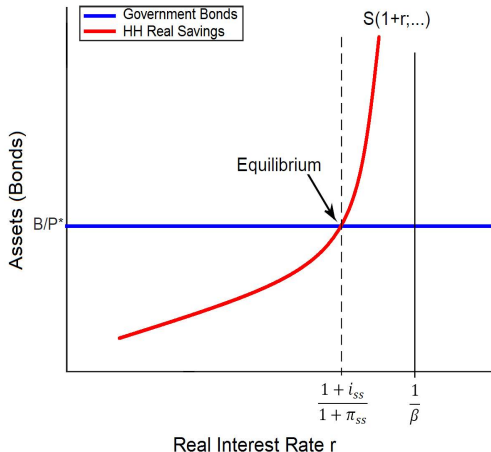


(B) Inflation

# HETEROGENEOUS AGENT NEW KEYNESIAN MODELS

- Offer different perspective on price level determinacy.
- Address Sargent and Wallace directly:  
Monetary policy controls return on short-term bond  $i$ .
- "No satiation point" arises endogenously.
- No need to explain why inflation is low although reserves explode.
- Consumption theory in line with empirical evidence.
- Fiscal policy matters big time.

# PRICE LEVEL DETERMINACY IN HANK



Real Interest Rate:

$$(1 + r) = \frac{1+i}{1+\pi}$$

Monetary Policy:

Sets  $1 + i$

Fiscal Policy:

$$\pi = \frac{B' - B}{B} = \frac{G' - G}{G} = \frac{T' - T}{T}$$

$i$  : nominal interest rate

$r$  : real interest rate

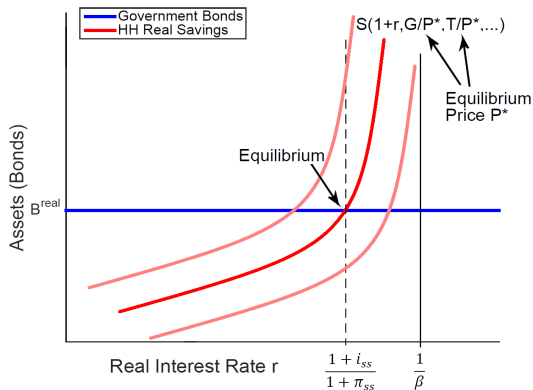
$\pi$  : inflation rate

$B$  : nominal bonds

$G$  : nominal government spending

$T$  : nominal tax revenue

# STEADY STATE PRICE LEVEL: FULLY PRICE-INDEXED BONDS $B^{real} = 0$



Real Interest Rate:

$$(1 + r) = \frac{1+i}{1+\pi}$$

Monetary Policy:

Sets  $1 + i$

Fiscal Policy:

$$\pi = \frac{B' - B}{B} = \frac{G' - G}{G} = \frac{T' - T}{T}$$

$i$  : nominal interest rate  
 $r$  : real interest rate  
 $\pi$  : inflation rate

$B$  : nominal bonds  
 $G$  : nominal government spending  
 $T$  : nominal tax revenue

## CONCLUSION

- The paper raises an important issue:  
Price level (in)determinacy.
- Different view on CB policy: controls money supply  $M$  and return  $i^M$ .
- Sargent and Wallace assumption that CB controls return on bonds is not applicable
- Obtain Price Level Determinacy
- Hagedorn (2016) "A Demand Theory of the Price Level":  
HANK models offer alternative perspective on  
Price level determinacy (and on monetary transmission,  
consumption, ...)