

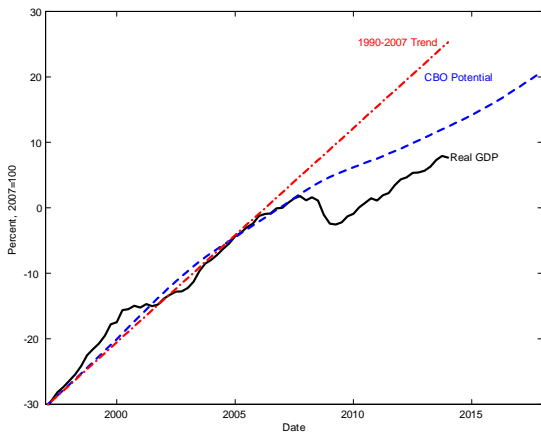
# Comments on 'A Model of Secular Stagnation'

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# Important paper – background

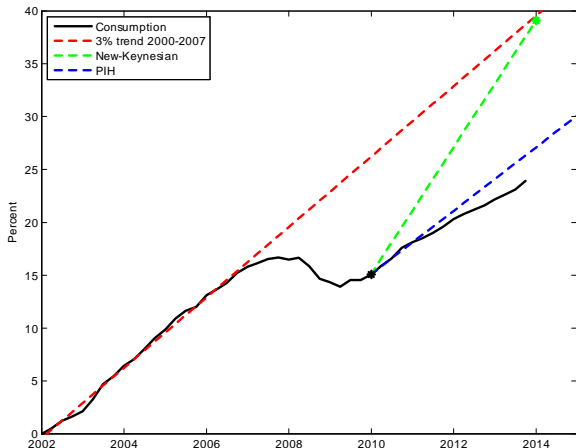


Steady low-positive inflation slump *following* recession/crisis.

1. "Demand" or "Distortions?" "Macro" or (no) "growth theory/micro?"
2. Zero bound/ sticky wage, or all the other wedges – tax, regulation, uncertainty, social programs, financial constraints, deleveraging, etc.?

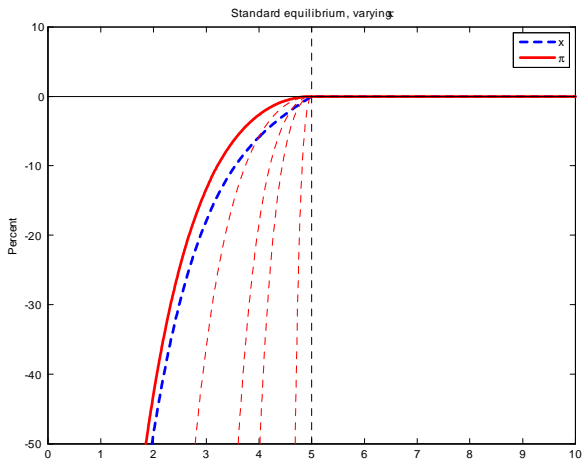
## Important paper – background

- ▶ NK models do not (easily) produce a steady, low & positive inflation, slump.



- ▶  $c_t = E_t c_{t+1} + \sigma^{-1}(i_t - \pi_t - r_t) \Rightarrow$  Low level  $\Leftrightarrow$  high  $E\Delta c$  growth.
- ▶  $\pi_t = \beta E_t \pi_{t+1} + \kappa y_t \Rightarrow$  Steady 2% inflation  $\neq$  big output gap.

# NK models do not produce a slump: example



- ▶ Werning (2012) model  $dx_t = \sigma^{-1}(i_t - r_t - \pi_t)$ ;  $d\pi_t = \rho\pi_t - \kappa x_t$ ;  $r < 0$  from  $t = 0$  to  $T = 5$ .
- ▶ Big gap – but big growth, deflation and big  $d\pi/dt$ .

# Important paper

- ▶ Steady low-inflation slump: “demand” or “distortions?”
- ▶ NK models do not produce a slump.

⇒

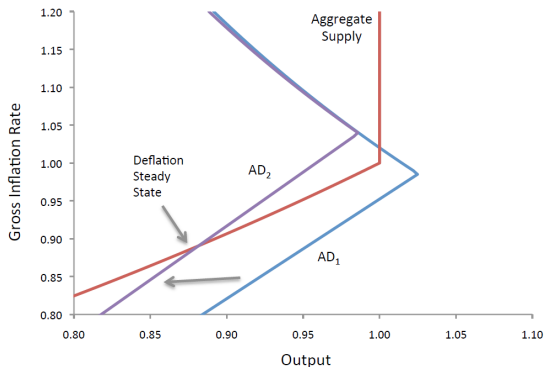
- ▶ “Secular stagnation” needs model, not blog posts.
- ▶ “Negative natural rate” needs economic source, separate measurement, not deus ex machina. (Distortions too, but possible.)
- ▶ Quantitative, not parable/sign/possibility. Is -2% really not enough? Can  $mpk$ ,  $\beta$ , etc. really be -5% or -10%?
- ▶  $r < 0$  is centrally a “monetary” policy problem – *sufficient  $\pi$  solves  $r < 0$  “secular stagnation.”* (Is that in ancient quotes?!) Key question, why is  $\pi$  so hard?
- ▶ That’s what this paper is about.

# Paper main point

- ▶ Hard paper, many moving parts.
  - ▶ 3 period OLG. Work only middle age. Save by lending to young. Borrowing constraint  $D_t$  on young. Wage sticky. Taylor rule with zero bound. Then extensions.
  - ▶ Despite perfect foresight, no full solution, steady state and some linearized dynamics
- ▶ Centerpiece: Section 4: A low-output, deflationary steady state.
- ▶ Centerpiece 2: Standard “Paradoxes” apply.

# Paper main point

Figure 3: Steady state aggregate demand and aggregate supply curves

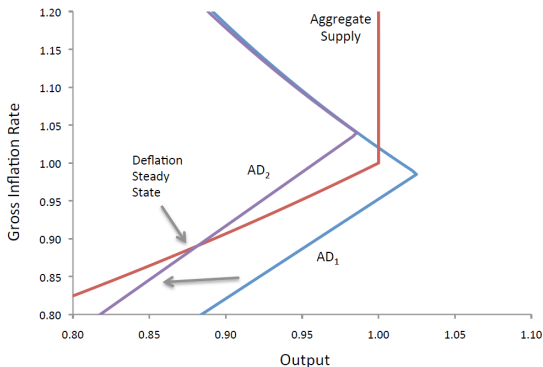


Group equilibrium conditions into

- ▶ “AS.”  $\{Y, \Pi\}$  downward sticky wages. Kink  $\Pi_t < 1$   $Y = L^\alpha$
- ▶ “AD.”  $\{Y, \Pi\}$  Taylor rule, savings. Kink where  $i = 0$ .

# Paper main point stagantion/deflation steady state

Figure 3: Steady state aggregate demand and aggregate supply curves



► Central questions to understand it

1. Why does output fall when there is deflation (AS)?
2. Why doesn't equilibrium inflation solve the problem? (AD)?
3. Why can't (doesn't) monetary policy engineer inflation?



# Why does Y fall in a deflation (“AS” “Phillips”)?

1. Firms static maximizers

$$\max_{L_t} P_t Y_t - W_t L_t \text{ s.t. } Y_t = L_t^\alpha \Rightarrow \alpha L_t^{\alpha-1} = \frac{W_t}{P_t}$$

2. “Wage norm” stickiness in labor supply:

$$L^s = \bar{L}, \text{ if } W \geq \tilde{W}; \quad L^s = 0, \text{ if } W < \tilde{W} \text{ where}$$

$$\tilde{W}_t = \gamma W_{t-1} + (1 - \gamma) P_t \alpha \bar{L}^{\alpha-1}$$

3. Employment determined by firm labor demand when binding

$$\alpha L_t^{\alpha-1} = \frac{\tilde{W}_t}{P_t}; \text{ otherwise } L_t = \bar{L}$$

4.  $Y_t = L_t^\alpha$ , steady state, algebra.....for  $\Pi < 1$ ,

$$\frac{Y}{\bar{Y}} = \left[ \frac{1 - \gamma \Pi^{-1}}{1 - \gamma} \right]^{\frac{\alpha}{1-\alpha}} \quad \text{or} \quad y \approx \bar{y} + \frac{\alpha}{1-\alpha} \frac{\gamma}{1-\gamma} \pi$$

## Why does Y fall in a deflation (“AS” “Phillips”)?

$$y \approx \bar{y} + \frac{\alpha}{1-\alpha} \frac{\gamma}{1-\gamma} \pi$$

- ▶ The steady state of this model displays a strong *static* Phillips curve when  $\pi < 0$ .
- ▶ How the model avoids NK

$$\pi_t = \beta E_t \pi_{t+1} + \kappa y_t$$

need for dynamic inflation.

- ▶ Lucas, Phelps, Friedman, Woodford, Calvo, adieu.
- ▶ Central: replace forward-looking Calvo etc. optimal price setting with backward-looking mechanical rigidity.
- ▶ Was going to complain about  $\pi < 0$  but easy to fix with “wage norm” that demands raises.
- ▶ Have fun with these microfoundations, data, wage vs. price stickiness, etc.

## Why doesn't inflation fix it? (“AD”, IS + Taylor)

$$Y - D = D \frac{(1 + \beta)}{\beta} (1 + g) \Pi$$

- ▶ Story: Middle age want to save  $Y$ . Can only do so by lending to young in fixed amount  $D$ .  $D, g$  is too low, so old bid down interest rate. But rate cannot fall below  $i - \pi = -\pi$ . When the rate hits  $i - \pi$ , output must fall instead, until old desire to lend = what young are able to borrow. Then real rate =  $i - \pi >$  natural rate. “Keynesian”  $Y$  adjusts so  $S=I$ .
- ▶ *Static AD to go with static Phillips!* Not

$$y_t = E_t y_{t+1} + \sigma^{-1} (i_t - \pi_t - r_t)$$

- ▶ How does the model avoid Intertemporal substitution, low level = large growth? A: Large growth from middle to old, not aggregate.

## Summary so far

- ▶ Steady states of this model resemble static paleo-Keynesian relations between  $Y$  and  $\Pi$ , not dynamic-intertemporal new-Keynesian relations between  $Y_t, E_t Y_{t+1}$  and  $\Pi_t, E_t \Pi_{t+1}$ .

$$Y - D = D \frac{(1 + \beta)}{\beta} (1 + g) \Pi$$

not

$$y_t = E_t y_{t+1} + \sigma^{-1} (i_t - \pi_t - r_t)$$

$$y \approx \bar{y} + \frac{\alpha}{1 - \alpha} \frac{\gamma}{1 - \gamma} \pi$$

not

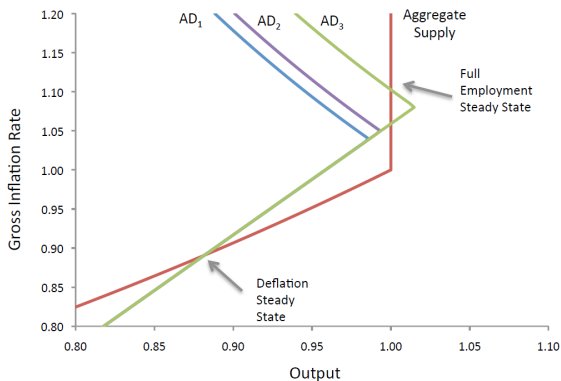
$$\pi_t = \beta E_t \pi_{t+1} + \kappa y_t$$

- ▶ Hence it can produce a slump in *levels*.
- ▶ Even though it's a respectable model.
- ▶ Key:
  1. Mechanically backward sticky wages in place of Calvo.
  2. OLG intertemporal allocation / constraint in place of aggregate consumption.
- ▶ Key includes Taylor rule.....

# Why doesn't monetary policy fix it?

- ▶ Another centerpiece: Changing  $\Pi^*$  a little does not help.

Figure 6: Effect of raising the inflation target

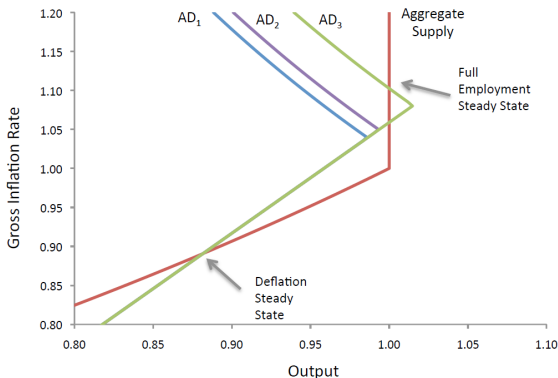


- ▶  $i = 0$  steady state, so Taylor rule ( $\Pi^*$ ) is irrelevant up to kink.

$$Y - D = D \frac{(1 + \beta)}{\beta} (1 + g) \Pi$$

# Inflation target

Figure 6: Effect of raising the inflation target

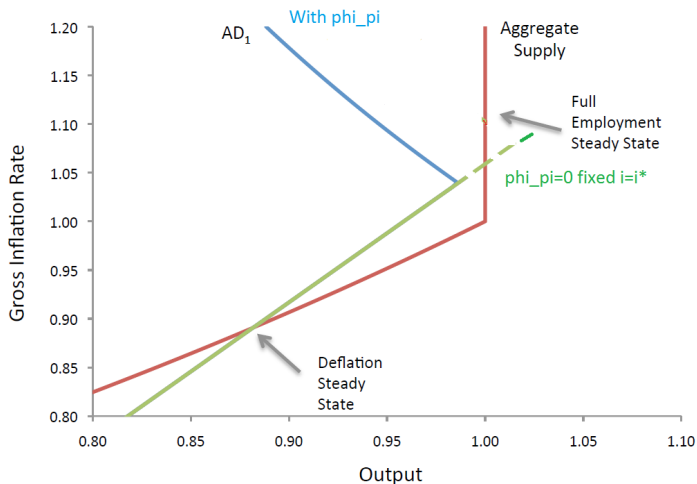


- ▶ Changing  $\Pi^*$  a lot solves the problem, but multiple equilibria.
- ▶ “our model is silent on how the government could coordinate expectations on the “good” full-employment equilibria” (p.22) = “our model makes no prediction on which equilibrium will be observed in the data.”

# Taylor rule is the central problem! Fix rates!

- ▶  $\phi_\pi = 0$ ,  $1 + i = 1 + i^*$  solves the problem! Get rid of the kink!
- ▶ Reminder:  $\phi_\pi$  is unobservable, unidentified, etc. “Fixed” = off-equilibrium; moves in stochastic models.

Effect of: Eliminating Taylor response  $\phi_\pi = 0$



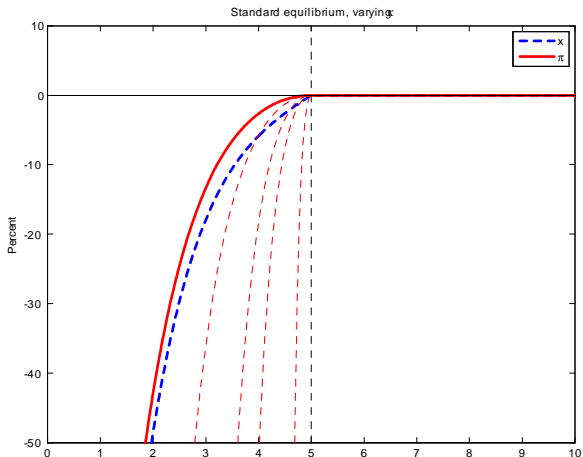
# Paradoxes

- ▶ All the laws of economics seem to change sign at the lower bound.
- ▶ Example: “..the paradox of flexibility...This paradox states that as prices become more flexible, output contracts. This is paradoxical since if all prices and wages were flexible, then there would be no contraction at all.” (p.19)
- ▶  $\gamma$  =stickiness.  $\lim_{\gamma \rightarrow 0} y(\gamma) \neq y(0)$ .
- ▶ Deep: Usually in economics, when a problem comes from a friction, fix the friction. Liberalize labor markets.
- ▶ Truly a weird behavior, no?



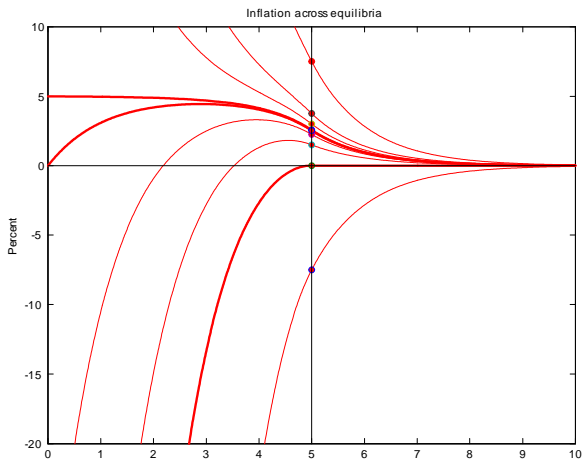
# Paradox of flexibility in Werning's model

- ▶ As prices get more flexible, output and inflation go down, not up to frictionless model  $x = 0$  and  $\pi = -r$

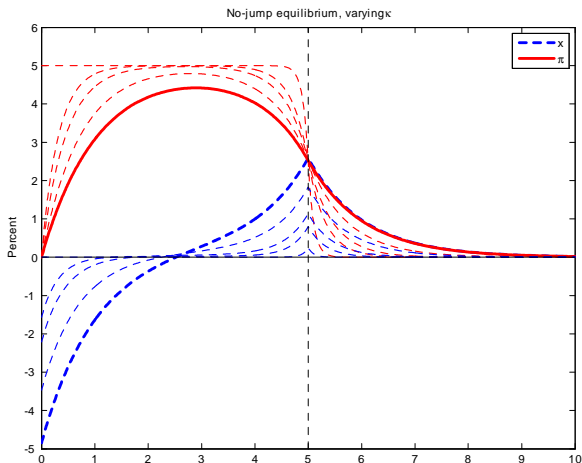


# Paradoxes in Werning model

- ▶ But there are many equilibria (dynamic, same steady state)..



# Paradoxes in Werning model



- ▶ And other equilibria smoothly approach frictionless limit.
- ▶ Large multipliers, also vanish in “most” equilibria.
- ▶ Similar analysis of this model?
- ▶ “Paradoxes” ready for policy or sign of model problem?

# Is the natural rate really strongly negative?

- ▶ Reminder. Point is quantitative, so foundations / realism matter.
- ▶ Saving by old constrained by borrowing of young.
  1. OLG model.. with no money! ( $i \geq 0$  imposed, not derived; no  $M$  in budget constraint)
  2. Standard result: “money” in OLG models means  $r \geq g$ .
  3. If Fed screws up money/wages can't deflate, use government debt (also absent), social security, old masters, or bitcoin!
  4. Durable goods / storage / lending abroad means  $r \geq 0$ .
  5. Marginal product of capital  $\ll 0$ ?? (Hobbled here by  $p_k$ )
- ▶ Borrowing of young  $\leq D$ .
  1. Real societies have lots of transfers to young. Schools, families, etc.
  2. Is underconsumption by young who will be rich really that big a problem?
  3. How much of past savings of middle age went to finance consumption loans of young?
- ▶ Ready for *measurement*?
- ▶ I'm still skeptical  $r \ll 2\%$   $i > 0$  is biggest wedge, but at least we have a structure to discuss.
- ▶ Ready for *policy*? Exploit paradoxes? Spend a Trillion bucks?

The end

The end

- ▶ OLG endowment economy, no money, no storage can produce negative real rate.
  - ▶ Permanent change in parameters produces permanent change in real rate.
  - ▶ Middle age lend to young to finance old consumption. More borrowing constraint  $\Rightarrow$  lower real rate.
- ▶ True, not surprising
- ▶ Obligatory effort to generate macroeconomic ills from inequality.
- ▶ Evidence for widespread unfulfilled desire for consumption loans?

# Paper Section 3

- ▶ Economy with  $i \geq 0$  and negative  $r$  must have positive inflation.
  1. "if the real rate of interest is permanently negative, there is no equilibrium consistent with stable prices" (p.11) Yes.
  2. "for an equilibrium with constant inflation to exist...steady state inflation is bounded from below by the real interest rate due to the zero bound" (p.11) Yes
  3. "if the economy calls for a positive inflation rate – and cannot reach that level due to policy (e.g. a central bank committed to low inflation) – the consequence will be a permanent drop in output instead" (p.12)
    - ▶ a) Not shown (equilibrium does "not exist"  $\neq$  "permanent drop in output")
    - ▶ b) No answer to how central bank chooses inflation – the whole problem of a liquidity trap

## Model details

Households:

$$\max \log C_t^y + \beta \log C_{t+1}^m + \beta^2 \log C_{t+2}^o$$

+ supply labor  $\bar{L}$  but refuse to work for  $W_t \leq W_{t-1}$ .

B.C.

$$C_t^y = B_t^y = \frac{D_t}{1+r_t}$$

$$C_{t+1}^m = \frac{W_{t+1}}{P_{t+1}} L_{t+1} + \frac{Z_{t+1}}{P_{t+1}} - (1+r_t)B_t^y + B_{t+1}^m$$

$$C_{t+2}^o = -(1+r_{t+1})B_{t+1}^m$$

$$(1+r_t)B_t^i \leq \bar{D}_t$$

Firms

$$\max_{L_t} P_t Y_t - W_t L_t \text{ s.t. } Y_t = L_t^\alpha \Rightarrow \frac{W_t}{P_t} = \alpha L_t^{\alpha-1}$$

Price stickiness

$$W_t \geq \gamma W_{t-1} + (1-\gamma) P_t \alpha \bar{L}^{\alpha-1} = \tilde{W}_t$$

(Need  $\gamma < 1$  or no steady state with  $\Pi < 1$ ). Thus

$$W_t = \max(\tilde{W}_t, P_t \alpha \bar{L}^{\alpha-1})$$



## OLG with no money/durables?

“Implicitly, we assume that the existence of money precludes the possibility of a negative nominal rate. At all times  $i_t \geq 0$ ” (p.11)”

OK, let's make that explicit!

*Why can't the middle age just hold money*

$$\max \log(C_t^m) + \beta \log(C_{t+1}^o)$$

$$Y_t = C_t^m + \frac{M_t^m}{P_t} + K_t$$

$$C_{t+1}^o = \frac{M_t^m}{P_{t+1}} + (1+r)K_t$$

$$M_t^m \geq 0; K_t \geq 0$$

$$Y_t = C_t^m + C_{t+1}^o \frac{P_{t+1}}{P_t}$$

FOC1/ $\Pi_{t+1} > r; K_t = 0 M_t > 0;$

$$\frac{1}{C_t^m} = \beta \frac{P_t}{P_{t+1}} \frac{1}{C_{t+1}^o}$$

$$C_{t+1}^o = \beta \frac{P_t}{P_{t+1}} C_t^m$$