The Paradox of toil

Gauti B. Eggertsson
Federal Reserve Bank of NY
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Q: What happens if you wake up one day and decide you want to work more for some time?

A: Presumably you find some work and work some more.

→Aggregate output increases by a tiny bit.

Q: What happens if everybody decide one day they want to work some more?

A: Presumably everybody works more and output increases?

NO not always.

-- Fallacy of composition

-- One in the theater stands up, sees better, but everybody?

-- Paradox of toil: Everybody tries to work more, then everybody will work less in general equilibrium once interest rate zero.

-- Paradox of thrift: Everybody tries to save more, there is less aggregate savings.

Special to environment of zero interest rate

Why interesting? Large part of the world today (not Brazil!)

Important Implication: Can't trust large number of empirical studies.

General point:

1. Expanding production frontier in the short run can be counterproductive.

→ payroll tax cuts, cutting minumum wage, GD policies.

2. Aggregate demand policies very effective:

→Gov. spending, investment tax credit, sales tax cuts.

Key lesson: Paradox of toil illustrates the subtle role of expectations at zero interest rates

Literature

Eggertsson (2010), “Paradox of toil”, unpublished.

Eggertsson (2010), “What fiscal policy is effective at zero interest rates”, NBER Macroeconomic Annual.

Eggertsson (2008), “Great Expectations and the End of the Depression”, AER.

Builds also on a large literature of the zero bound

Structure

1. Model
2. Short-run, long-run (trick)
3. What happens when everybody starts trying to work more under normal circumstances?
4. Peculiar world of zero bound: Output collapses
5. Applications of theory, policy experiments, and empirical predictions.
6. Great Depression, Great Recession and beyond.

The Model

Households

shocks

$$\max \; E_t \sum_{T=t}^{\infty} \beta^{T-t} \left[u(C_T) - \psi_T v(l_T) \right] \xi_T$$

s.t. budget constraint

Monetary policy instrument

$$B_t = (1 + i_{t-1}) B_{t-1} + \int_0^1 \Pi_T(i) di + P_t W_t l_t - P_t C_t - T_t$$

Consumption and price indices

$$C_t \equiv \left[\int_0^1 c_t(i)^{\frac{\theta-1}{\theta}} di \right]^{\frac{\theta}{\theta-1}}, P_t \equiv \left[\int_0^1 p_t(i)^{1-\theta} di \right]^{\frac{1}{1-\theta}}$$

Firms

-- linear production

-- Prices only at staggered intervals.

-- Only get to change price with probability 1-α as in Calvo

Approximated equilibrium conditions

shock

$$\hat{Y}_t = E_t \hat{Y}_{t+1} - \sigma(i_t - E_t \pi_{t+1} - r^*(\xi_t))$$

People determine "demand", i.e. overall spending

$$\hat{Y}_t = \hat{l}_t$$ Labor demand

$$\pi_t = \kappa \hat{W}_t + \beta E_t \pi_{t+1}$$

Firms supply whatever is demanded but demand has effect on their pricing

shock

$$\hat{W}_t = \omega \hat{l}_t + \sigma^{-1} \hat{Y}_t + \hat{\psi}_t$$

Labor supply

Approximated equilibrium conditions

AD $$\hat{Y}_t = E_t \hat{Y}_{t+1} - \sigma(i_t - E_t \pi_{t+1} - r_t^*)$$

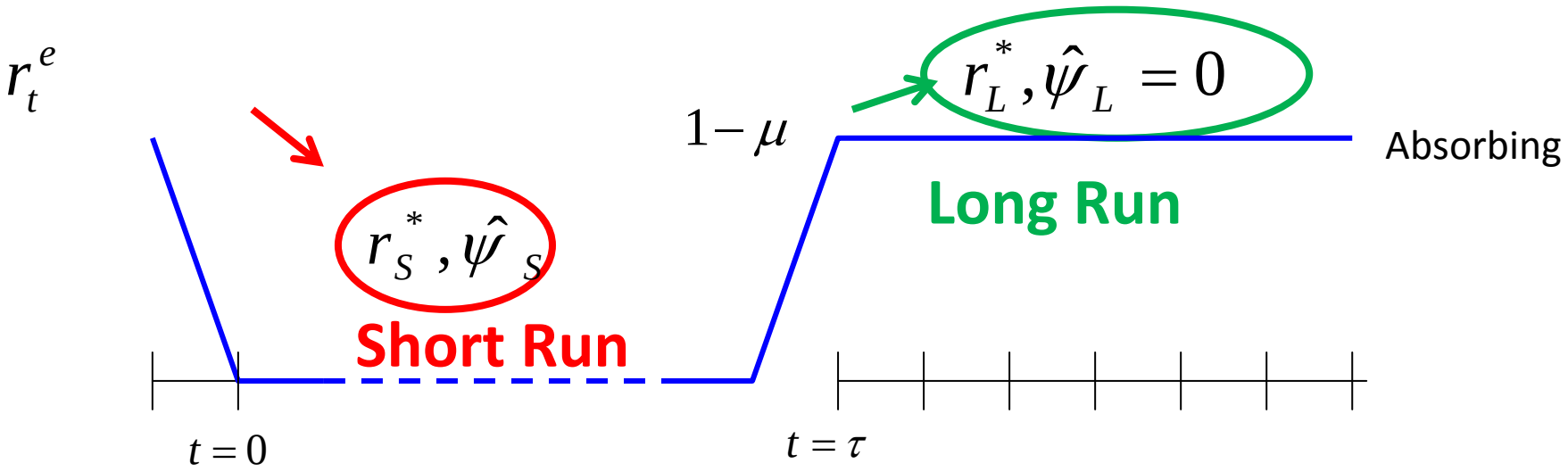
AS $$\pi_t = \kappa \hat{Y}_t + \beta E_t \pi_{t+1} + \delta \hat{\psi}_t$$

ZB $$i_t \geq 0$$

Taylor Rule $$i = \max(0, r_t^* + \phi_\pi \pi_t)$$

Two states:
short run and long run
transition prob 1-μ.

$t<\tau$ $\qquad$ $t\geq\tau$



Solution at positive interest rates:

Boils down to only two equations! In two unknowns!

$$\left.\begin{aligned} \hat{Y}_S &= \mu \hat{Y}_S - \sigma[\phi_\pi - \mu]\pi_S \\ \pi_S &= \kappa \hat{Y}_S + \mu\beta\pi_S \end{aligned}\right\} \quad t < T^e$$

Purely forward looking

For $t \geq \tau$

$$\hat{Y}_L = \pi_L = 0$$

For $t < \tau$

$$E_t \hat{Y}_{t+1} = (1-\mu)\cdot 0 + \mu \cdot \hat{Y}_S$$

$$E_t \pi_{t+1} = (1-\mu)\cdot 0 + \mu \cdot \pi_S$$

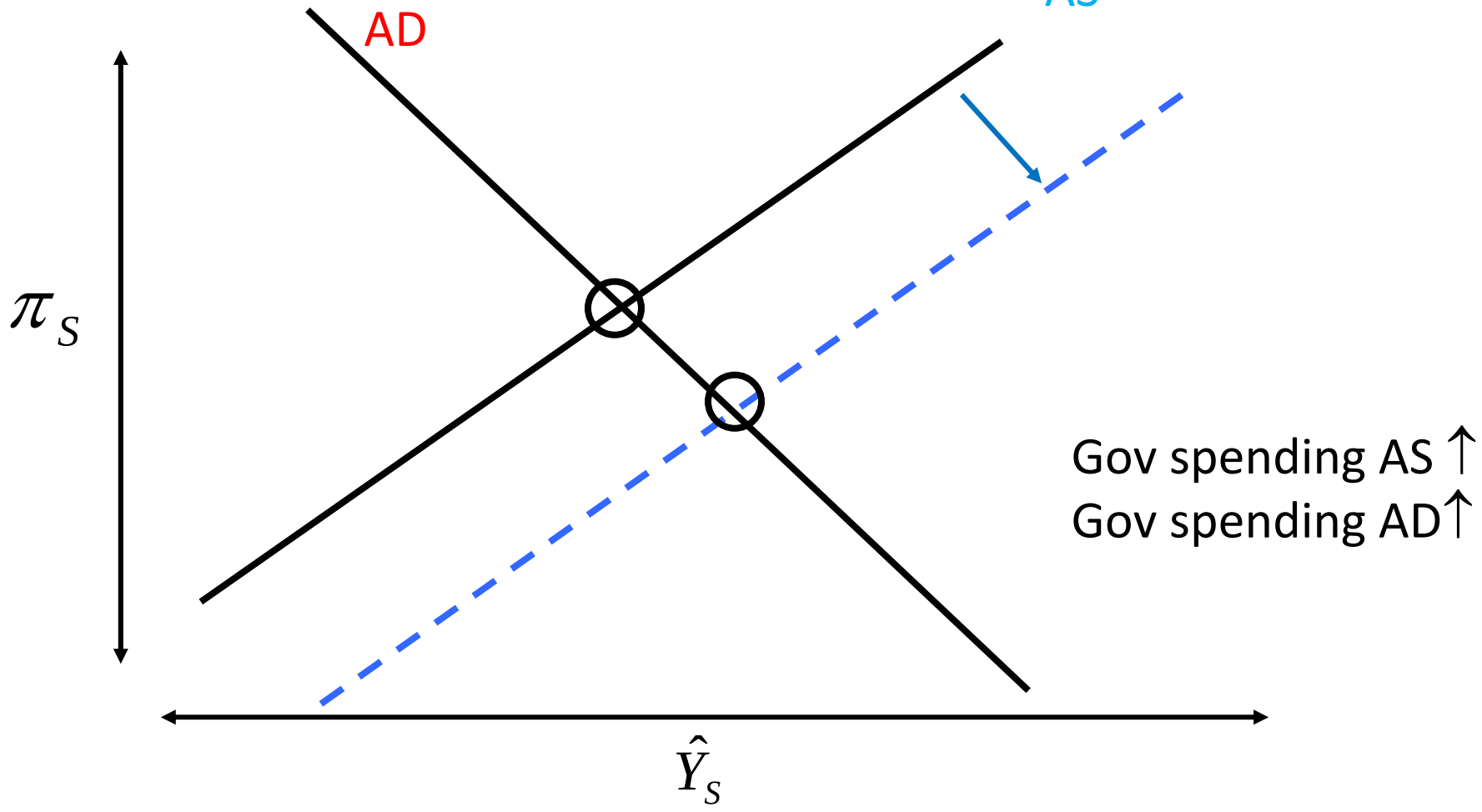
and $i_t = r_S^e + \phi_\pi \pi_S$

AD

$$\hat{Y}_S = -\sigma \frac{\phi_\pi - \mu}{1-\mu} \pi_S$$

AS

$$\pi_S = \frac{\kappa}{1-\mu\beta} \hat{Y}_S + \frac{\delta}{1-\mu\beta} \hat{\psi}_S$$



Under regular circumstances

- "Standard" intuition applies
- No funny business in the model
- Undergraduate textbooks work just as well as graduate ones
- Will now talk about the peculiar circumstances that arise *when interest rate zero* →paradox of toil and thrift. [Very large gov. spending and (some) tax cut multipliers]

Solution at zero interest rates:

Boils down to only two equations!

In two unknowns!

$$\hat{Y}_S = \mu \hat{Y}_S + \sigma\mu\pi_S + \sigma r_S^*$$

$$\pi_S = \kappa Y_S + \mu\beta\pi_S + \delta\psi_S^s$$

$t < T^e$

Purely forward looking

Before we had the term

$$-\sigma\phi_\pi\pi_S$$

For $t \geq T^e$

$$\hat{Y}_L = \pi_L = 0$$

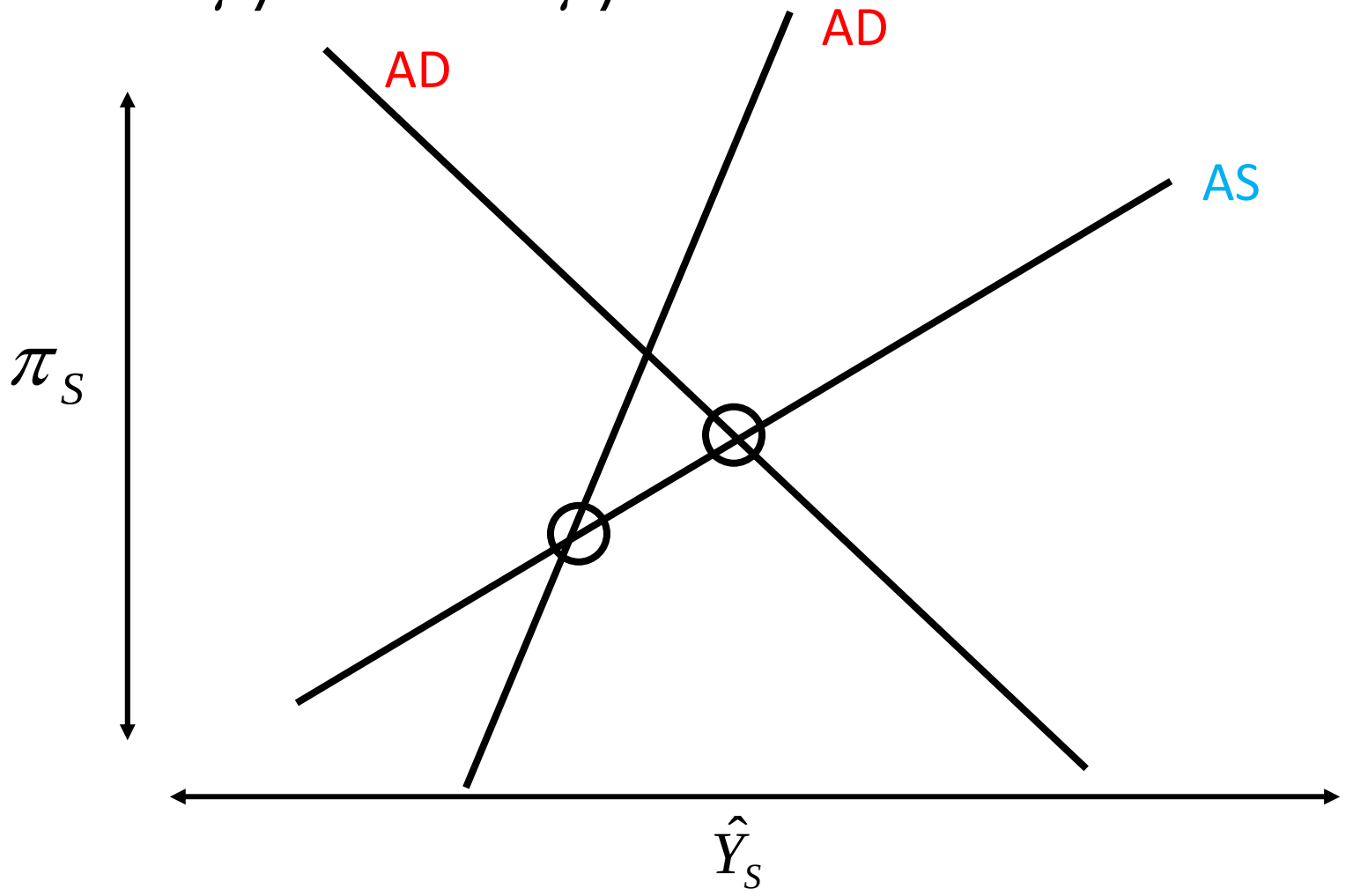
$$E_t\hat{Y}_{t+1} = (1-\mu)\cdot 0 + \mu\cdot\hat{Y}_S$$

$$E_t\pi_{t+1} = (1-\mu)\cdot 0 + \mu\cdot\pi_S$$

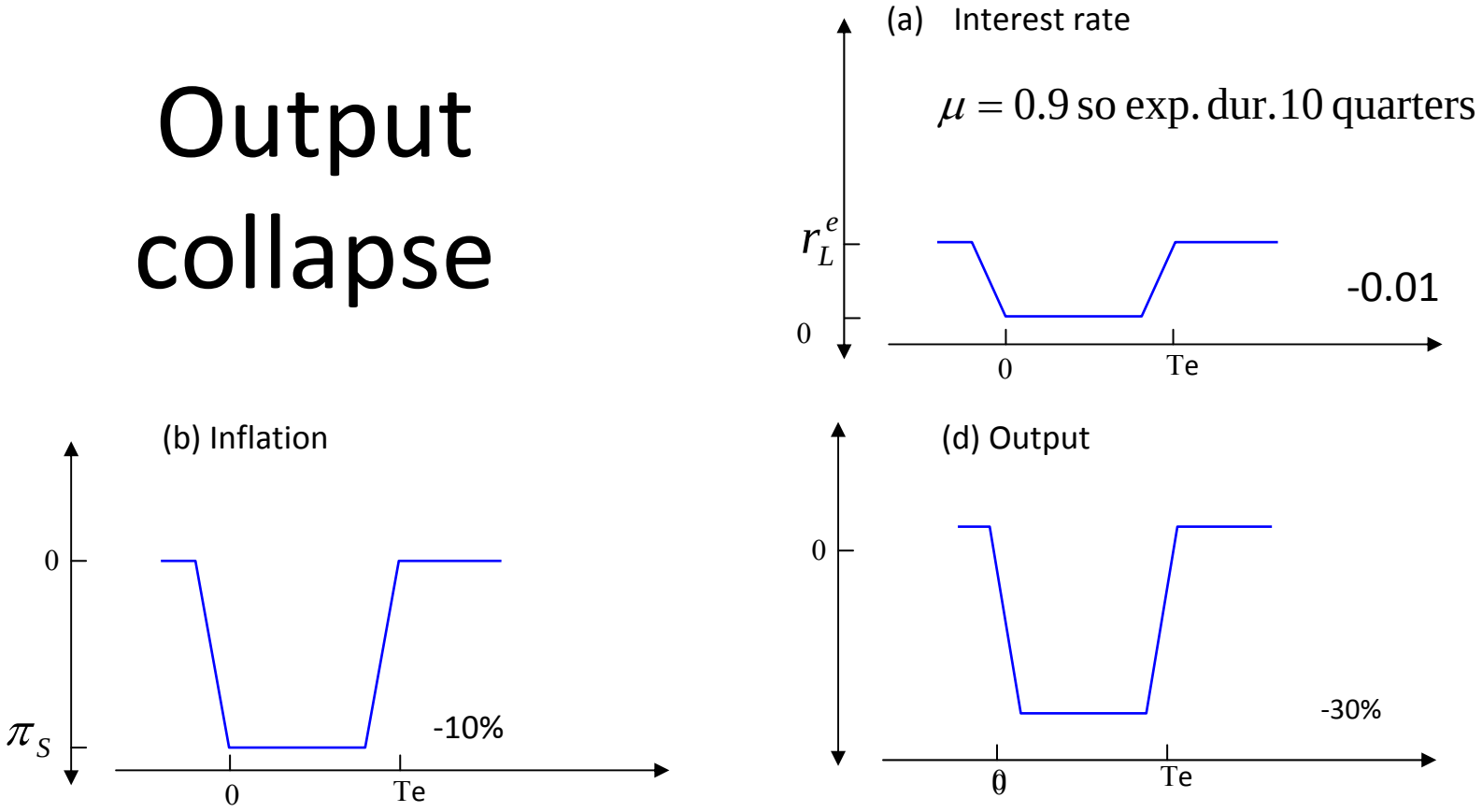
and $i_t = i_S = 0$

AD $\hat{Y}_S = -\sigma \dfrac{\phi_\pi - \mu}{1-\mu}\pi_S$ ➔ $\hat{Y}_S = \sigma \dfrac{\mu}{1-\mu}\pi_S + \dfrac{\sigma}{1-\mu} r_S^*$

AS $\pi_S = \dfrac{\kappa}{1-\mu\beta}\hat{Y}_S + \dfrac{o}{1-\mu\beta}\hat{\psi}_S$



Output collapse



Why output collapse?

$$\hat{Y}_t = E_t\hat{Y}_{t+1} - \sigma(i_t - E_t\pi_{t+1} - r_t^e)$$

Expectations of future deflation → EY(t+1) very negative → vicious cycle→ Output collapse

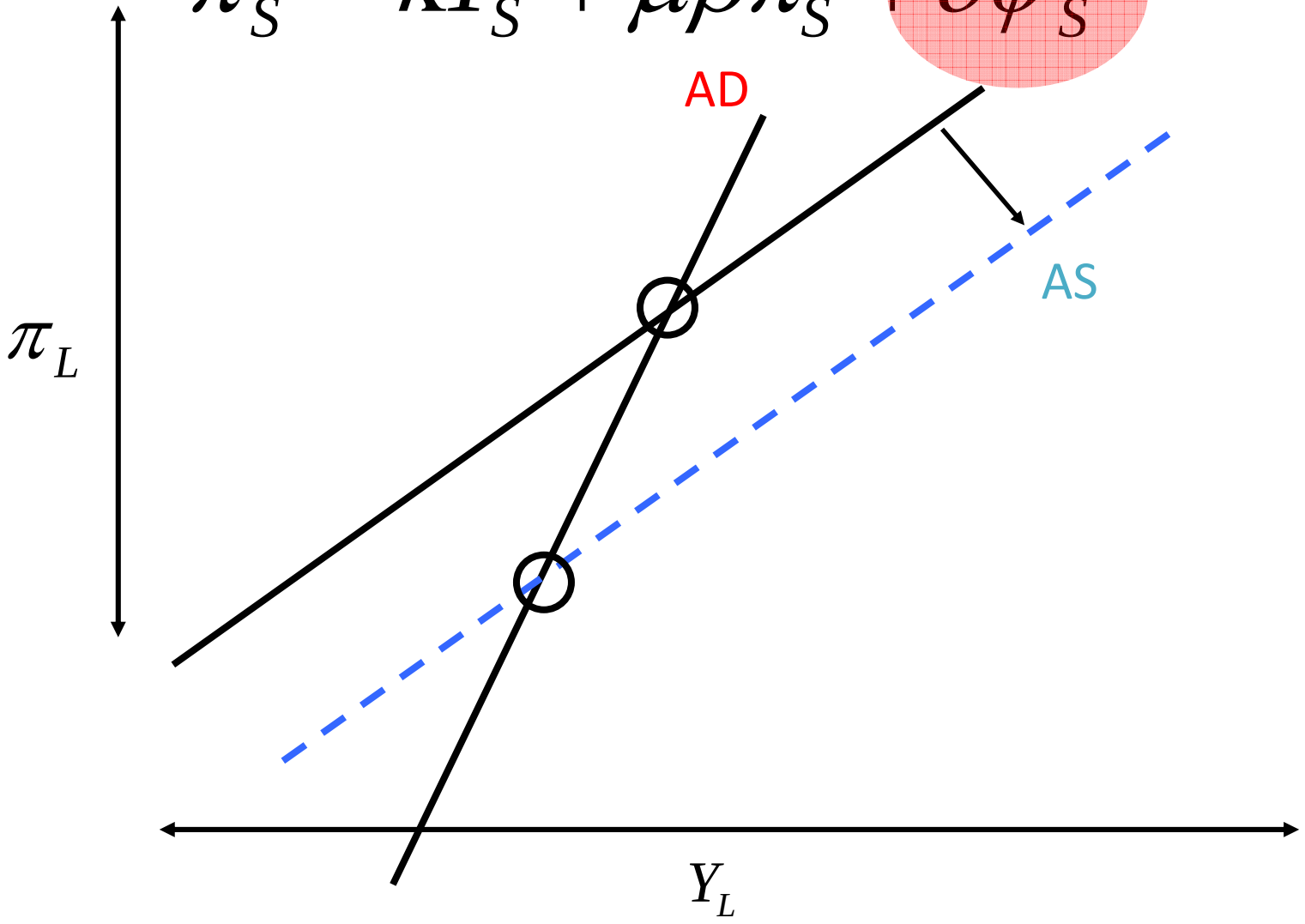
Real interest rates were in double digits in 29-33 due to deflation

Contractionary spirals

- Cut interest rate to zero
- Can’t go further so real interest rate “too high”
- Output “too low” thus making deflation even worse
- Makes real interest rate even higher
- Unstable dynamics, can go on without a bound.

$$\hat{Y}_S = \mu\hat{Y}_S + \sigma\mu\pi_S + \sigma r_S^e$$

$$\pi_S = \kappa\hat{Y}_S + \mu\beta\pi_S + \delta\hat{\psi}_S$$



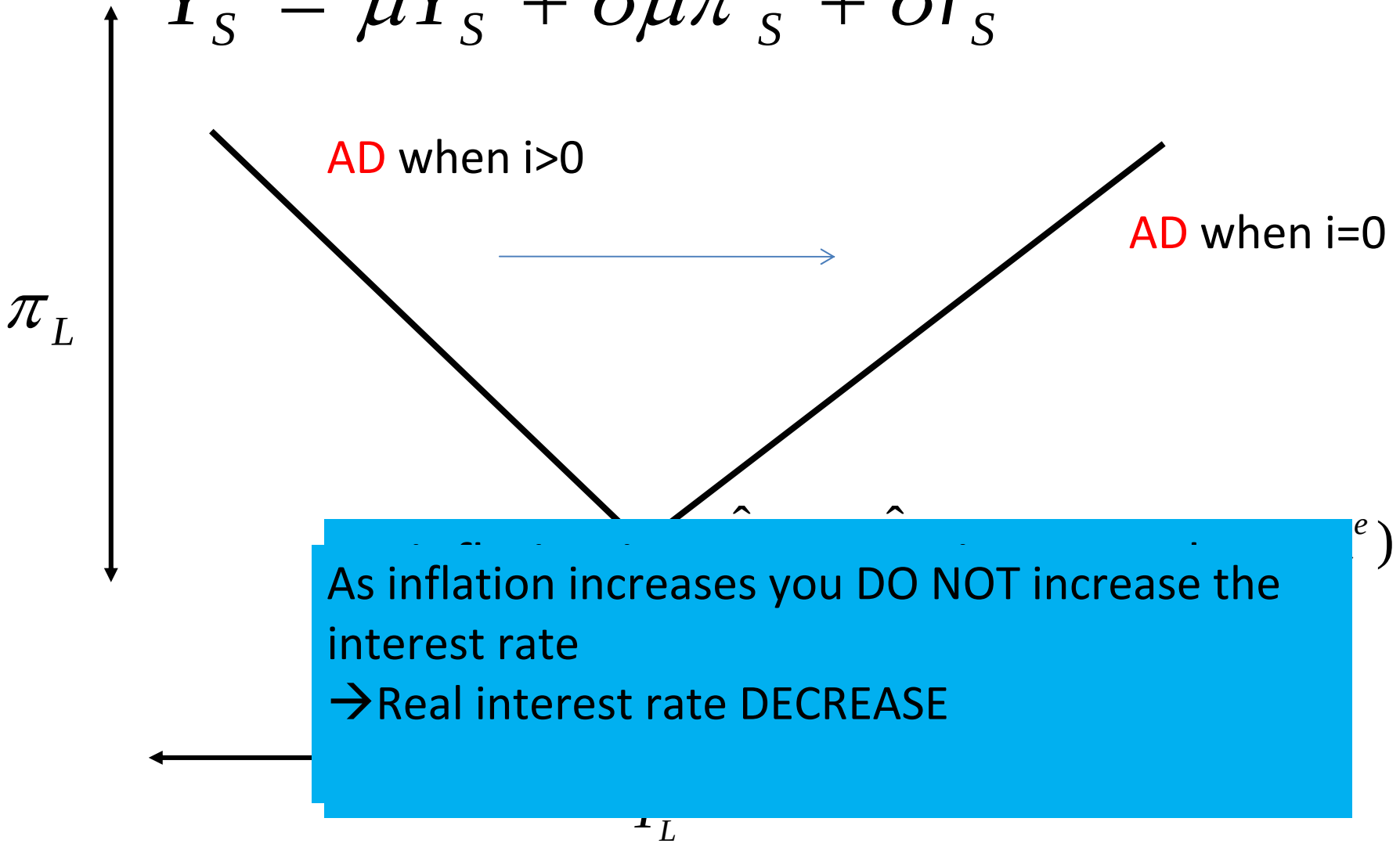
An increase in work supply counterproductive in US today

Intuition

$$\hat{Y}_t = E_t\hat{Y}_{t+1} - \sigma(i_t - E_t\pi_{t+1} - r_t^e) \quad \Big| \quad \pi_t = \kappa\hat{Y}_t + \beta E_t\pi_{t+1} + \delta\hat{\psi}_t$$

$$\hat{Y}_S = -\sigma i_S = -\sigma\phi_\pi \pi_S - \sigma\phi_y \hat{Y}_S \quad \hat{Y}_S = -\frac{\sigma\phi_\pi}{1+\sigma\phi_y}\pi_S$$

$$\hat{Y}_S = \mu\hat{Y}_S + \sigma\mu\pi_S + \sigma r_S$$



As inflation increases you DO NOT increase the interest rate

→Real interest rate DECREASE

Approximated equilibrium conditions

shock

$$\hat{Y}_t = E_t \hat{Y}_{t+1} - \sigma(i_t - E_t \pi_{t+1} - r^*(\xi_t))$$

People determine "demand", i.e. overall spending

$$\hat{Y}_t = \hat{l}_t$$ Labor demand

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shock

$$\hat{W}_t = \omega \hat{l}_t + \sigma^{-1} \hat{Y}_t + \hat{\psi}_t$$

Labor supply

Paradox of Toil

Paradox of toil : Giving people the incentive to work more counterproductive. More supply of labor -> lower wages -> deflationary pressures → higher real rates. [in equilibrium this reduces aggregate work].

It is counterproductive to increase production capacities of the economy when the problem is insufficient aggregate spending

Don’t need to increase your ability to fry hamburgers if nobody is buying them.

What is toil? Most obvious implication

Temporary payroll tax cuts counterproductive

	Payroll tax multiplier	Gov spending multiplier
Positive interest rate	0.16	0.48
Zero interest rate	-1	2.3

Multiplier flips sign at zero.

Applies to most other multipliers, i.e. very different at zero and at positive.

Implication: Can't use data at positive interest rate to base inference (Romer and Romer, Barro, Argania and Alesina, etc).

Counter to conventional wisdom

Edward Prescott, Council of Foreign Relations:
"Don't subsidize inefficiency. Cut tax rates to get people to work more. This financial stuff is much ado about nothing."
Bils and Klenow (2008):

- Payroll tax cuts stimulates employment directly by reducing tax penalties
- "Works directly on demand"
- "Works in all business cycle models"

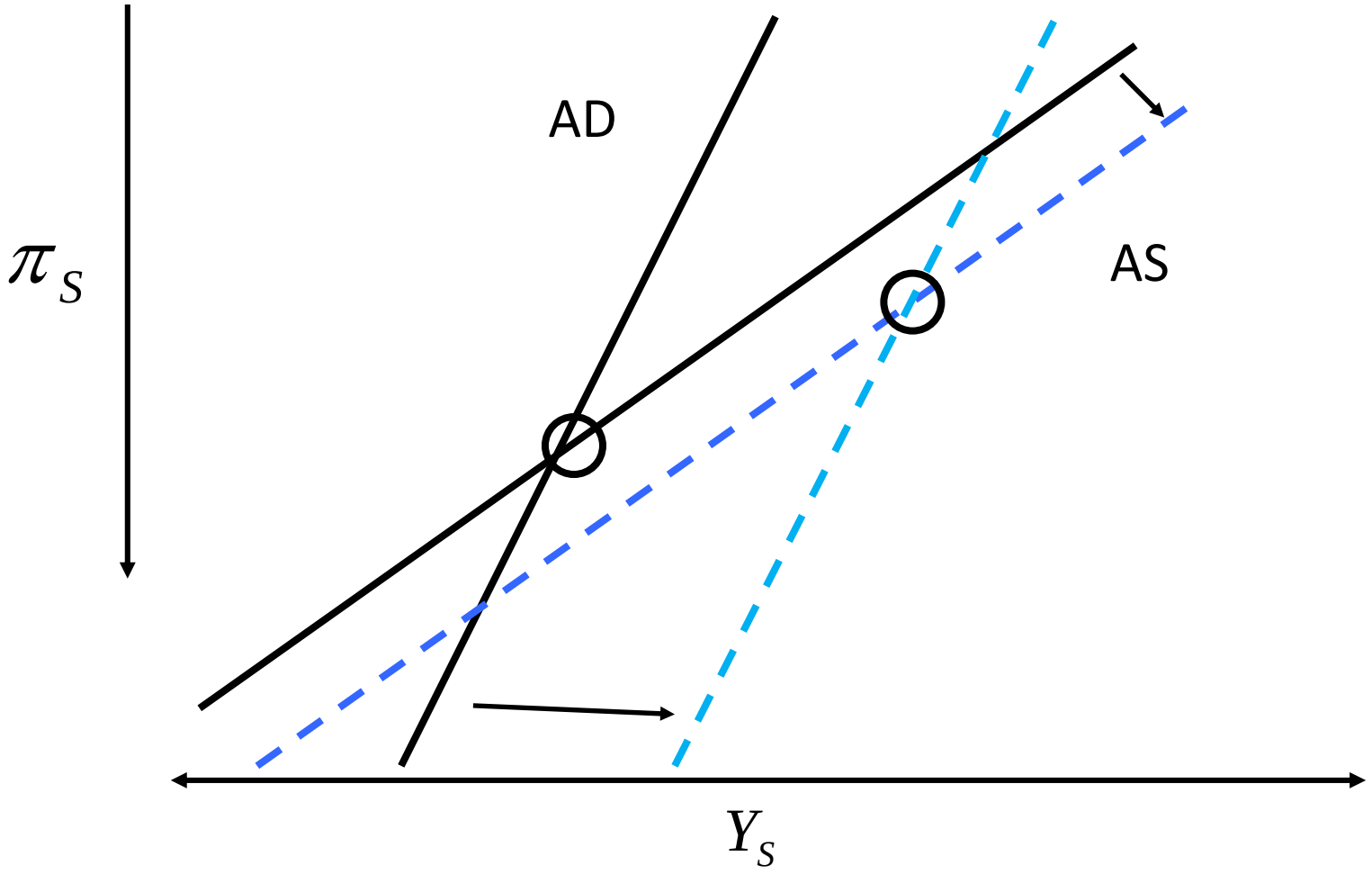
Hall & Woodward, Becker, and Mankiw raise similar arguments.

More generally

- Focus on stuff that increases spending
- Tax cuts only effective to the extent they do so.
- Not for RBC reasons.
- Gov spending can be very effective

$$\hat{Y}_S = \mu\hat{Y}_S + \sigma\mu\pi_S + \sigma r_S^* + (1-\mu)\hat{G}_S$$

$$\pi_S = \kappa\hat{Y}_S + \mu\beta\pi_S - \kappa\psi\sigma^{-1}\hat{G}_S$$



Large effects of things that effect demand

	Payroll tax multiplier	Gov spending multiplier
Positive interest rate	0.16	0.48
Zero interest rate	-1	2.3

Other examples of effective demand policies:

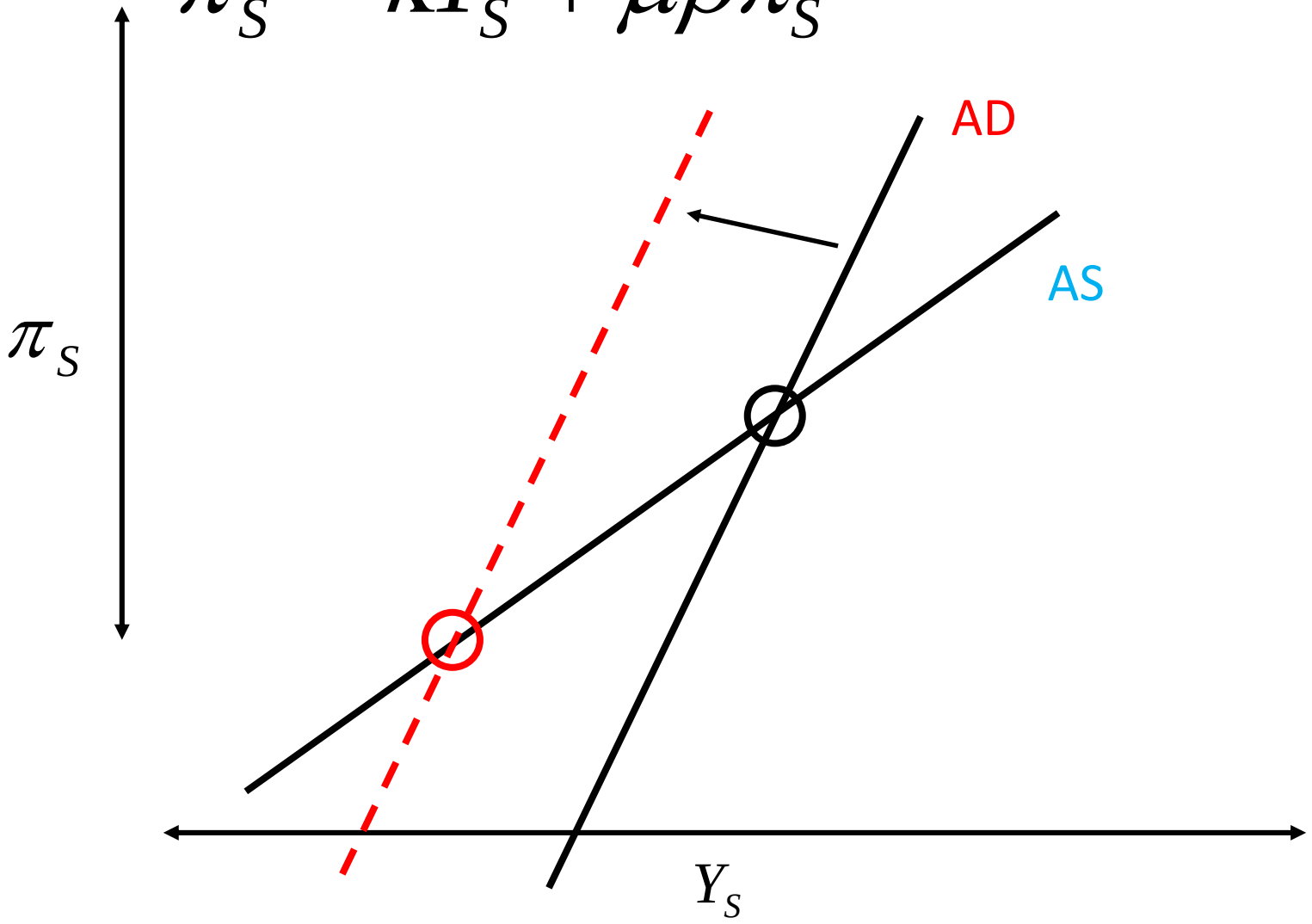
Sales tax cuts

Investment tax credits

Capital tax cuts contractionary (paradox of thrift)

$$\hat{Y}_S = \mu\hat{Y}_S + \sigma\mu\pi_S + \sigma r_S^* + \sigma\tau_S^A$$

$$\pi_S = \kappa\hat{Y}_S + \mu\beta\pi_S$$



Cutting taxes on capital

- Contractionary because it gives people and incentive to save when the model cries out for spending but NOT saving.
- Note, no endogneous investment, so no savings in aggregate apart from government debt.
- What happens with capital (will see later) (savings = investment)
- Turns out that increasing people incentive to save
  - → reduces aggregate demand
  - → reduces peoples ability to save
  - → **Aggregate savings** (investment) collapses because everyone tries to save!
  - → Paradox of thrift (Keynes (1936), Christiano (2004))
- Observe, this is a tax on savings, not on "returns". In practice, capital taxes are taxes on nominal returns, *which are zero for a risk-free bond*.

	Labor tax cut multiplier	Capital tax cut multiplier
Positive interest rate	0.16	-0.0013
Zero interest rate	-1	-0.1

Monetary Expansion

- Commitment to inflate.
- Consider a commitment to inflate the economy.

$$i_t = \max(0, r_t^e + \pi^* + \phi_\pi(\pi_t - \pi^*) + \phi_y \hat{Y}_t)$$

- Has a large expansionary effect.
- Equivalent to committing to higher future money supply.

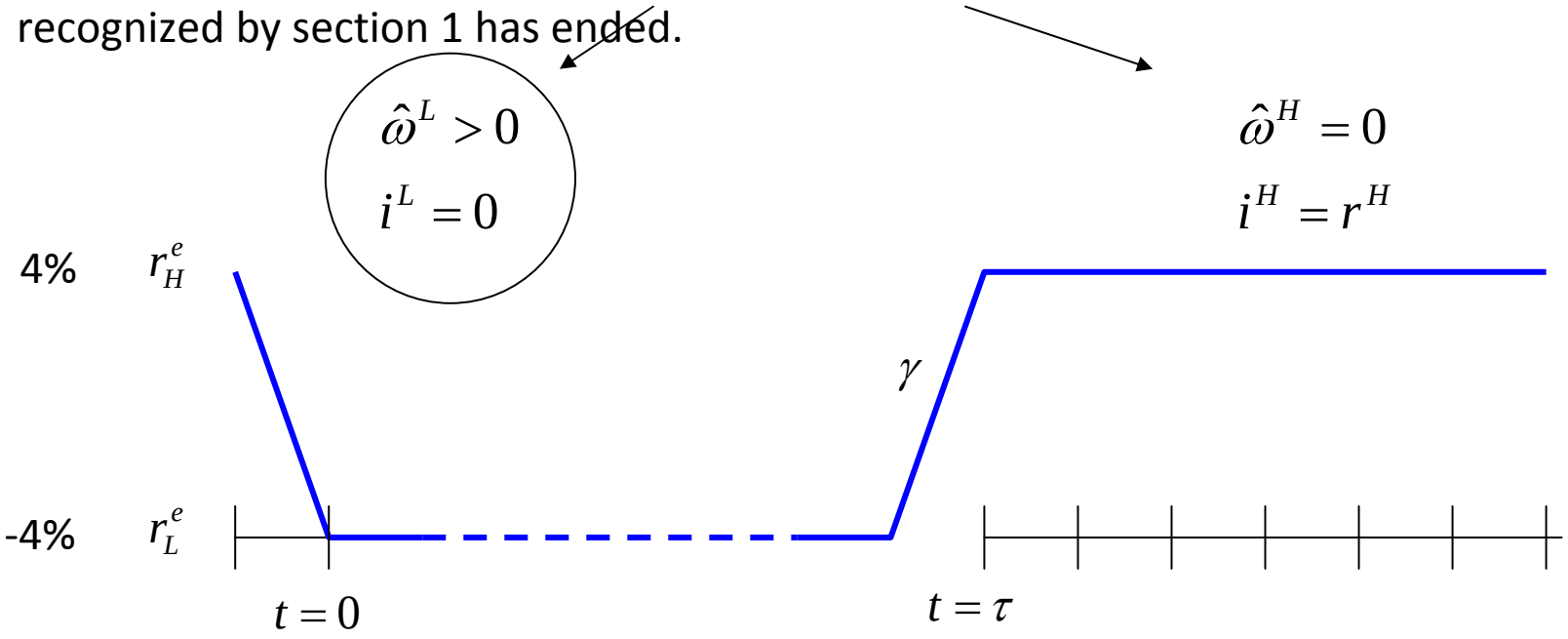
However,

- expansionary monetary policy does not overturn the main results qualitatively (but changes the quantitatively the value of the multipliers).
- Problem with monetary policy:
- Dynamically inconsistent.
- Have an incentive to promise inflation and output expansion and renege [Eggertsson, JMCB, 2006].
- **Note policy here is really working through inflation expectations.**

Application:
Was the New Deal Expansionary?

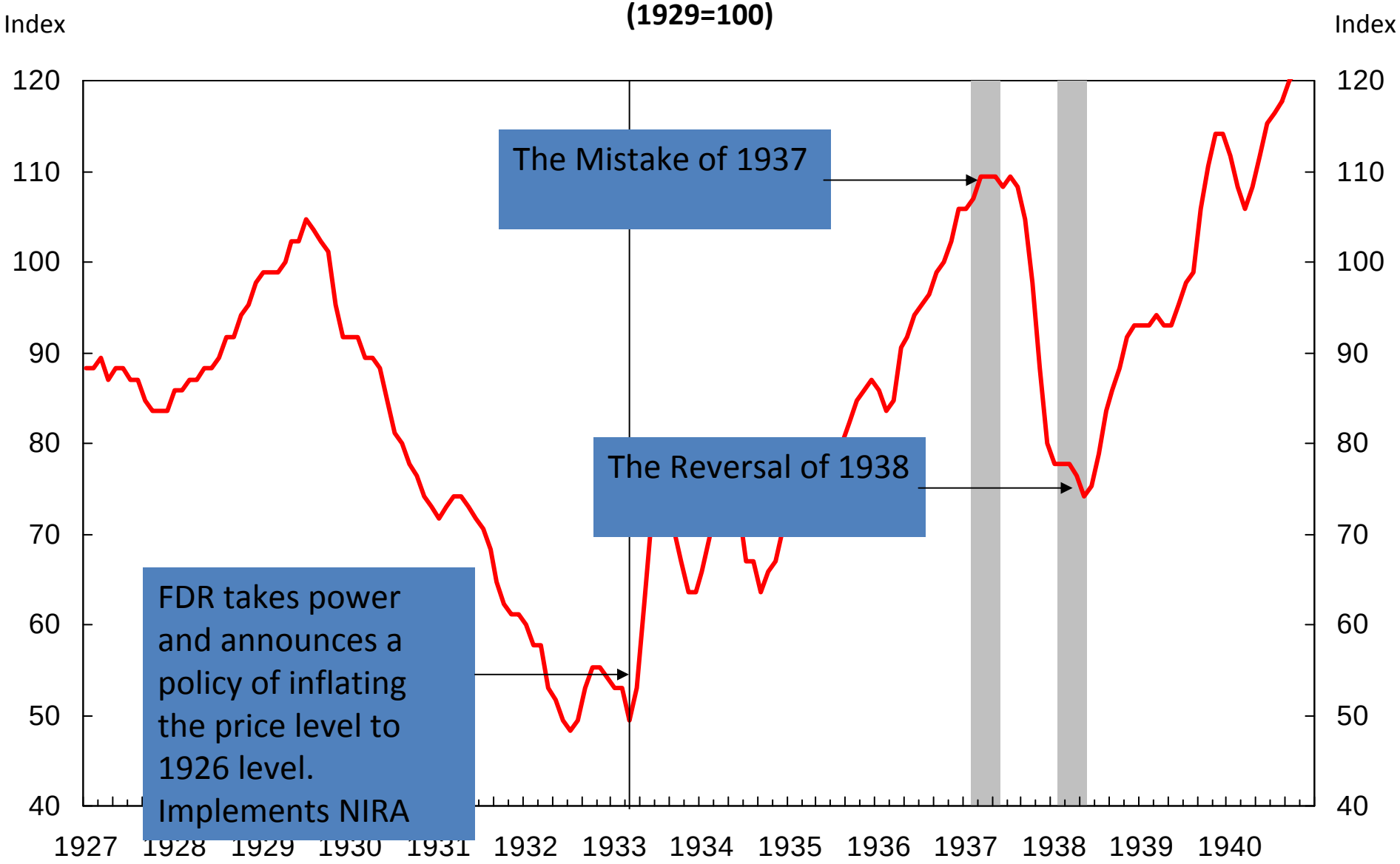
Motivation, National Industrial Recovery Act:
Increased monopoly power of firms and workers (a long literature has spoken against it. Friedman, Keynes, Cole and Ohanian)
A national Emergency productive of widespread unemployment and disorganization of industry […] is hereby declared to exist.

This title shall cease to be in effect and any agencies established hereunder at the expiration of two years after the data of enactment of this Act, or sooner if the President shall by proclamation or the Congress shall by joint resolution declare that the emergency recognized by section 1 has ended.



Industrial Production

(1929=100)



Source: Federal Reserve Board

Can we test the paradox of toil?

What is the effect of exogenous variations in production capacities of the economy?
Flips sign at zero.
Oil prices an example?
Prediction of theory:
Impulse responses should flip signs in Japan in 1997.
Blanchard and Gali (2007)
Preliminary results: They do.

Sensitivity

1.A property of most modern DSGE models.
→ Either reveals troubling policy conclusion or bad news for our models
2. More flexible prices, stronger results.
3. Wage rigidities
→ source of rigidities not the main issue
→ matters for the effect of tax policy

Conclusions

- Increasing supply can be counterproductive at zero interest rate.
- Everybody want to work more → everybody will work less.
- Gives one pause when studying a large number of policy proposals.
- An economic stimulus plan has fundamental different properties at zero interest.
- Theory suggests some tax cuts better than others.
- Should focus on those tax cuts and which increase demand – rather than those that increase supply.
- Gov. spending works well.