What Fiscal Policy is Effective at Zero Interest Rates?

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Motivation: Fiscal Expansion Today

- The current fiscal expansion the greatest in peace time since 1933.
- Estimated deficits of gigantic proportions
- Basic question: What’s the effect of cutting taxes and increasing spending in a standard New Keynesian model at zero interest rates.

Starting point: Some discussion on labor and capital tax cuts

- Labor tax cuts:
  - Bils and Klenow (2008):
    - Payroll tax cuts stimulates employment directly by reducing tax penalties
    - "Works directly on demand"
    - "Works under all business cycle models"
  - Hall & Woodward, Becker, and Mankiw raise similar arguments.
  - 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."
- Capital tax cuts
  - Barro (2009)

  "On the tax side, we should avoid programs that throw money at people and emphasize instead reductions in marginal income-tax rates -- especially where these rates are already high and fall on capital income."

  -- Feldstein (2009)

This paper

- Standard “New Keynesian” model
- Fiscal policy under the “current circumstance”.
  - Intertemporal shocks so that the nominal interest rate is zero (origin: financial sector)
- Consider temporary variations in taxes and spending in response to this shock.
- Findings:
  - Cutting labor taxes and/or capital taxes ***contractionary.***
  - Cutting sales taxes, investment tax credit or increasing government spending ***expansionary***.
- Special to zero interest rates:
  - Cutting labor taxes “normally” expansionary
  - Cutting capital taxes “normally” has little effect
  - Increasing government spending (cutting sales taxes) usually less than one. Multiplier more than 6 times larger at zero (goes from 0.32 to 2.27).
  - Implication: Can’t use empirical work at positive interest rate. Theory better benchmark.

Basic point

- At zero interest rates “insufficient demand” is the problem
- Policy (either tax cuts or spending increases) should aim at:
  - INCREASING DEMAND – get more spending going.
  - Increasing supply is *counterproductive*
- Don’t want to produce more when the problem is that there are not enough buyers!
- Paradox of thrift (old): Giving people the incentive to *save more* (cutting capital taxes) reduces spending. [in equilibrium this <u>reduces aggregate savings</u>]
- Paradox of toil (new): Giving people the incentive to work more counterproductive. More supply of labor -> lower wages -> deflationary pressures → higher real rates. [in equilibrium this <u>reduces aggregate work</u>]
- Sidepoint: What did the “Obamaplan” do? Increase output by 3.6 percent.

Plan

1. Basic model, key results –
   i. <u>contractionary</u> labor income tax cuts
   ii. <u>contractionary</u> capital tax cuts
2. Other demand and supply policies
   i. a. expansionary government spending
      b. irrelevant government spending
   ii. sales tax cuts
   iii. Cutting taxes on profits and investment tax credit
   iv. monetary policy
3. Quantitative evaluations
4. Conclusions

The Model

Households

shock

Utility

$$\max \ E_t \sum_{T=t}^{\infty} \beta^{T-t} \left[u(C_T + G_T^S) + g(G_T^N) - \int_0^1 v(L_T(j))\,dj \right] \xi_T$$

s.t. budget constraint

Fiscal policy instruments

$$B_t = (1-\tau_{t-1}^A)(1+i_{t-1})B_{t-1} + (1-\tau_t^P)\int_0^1 \Pi_T(i)\,di$$

$$+ (1-\tau_t^w)\int_0^1 w_T(j)L_T(j)\,dj - (1+\tau_t^s)P_t C_t - T_t$$

Consumption and price indices

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

The Model

Sticky Prices

Monapolistically competetive firms and linear production function

$$y_t(i) = Y_t\left(\frac{p_t(i)}{P_t}\right)^{-\theta} \qquad\qquad y_t(i) = L_t(i)$$

Calvo prices. Fraction (1-α) of firms set new prices in each period (exclusive of sales tax).

$$\max_{p_t^*} E_t\left\{\sum_{T=t}^{\infty}(\alpha\beta)^{T-t} Q_{t,T}(1-\tau_T^P)\left[p_t^*\left(\frac{p_t^*}{P_T}\right)^{-\theta} Y_T - w_T(j)\left(\frac{p_t^*}{P_T}\right)^{-\theta} Y_T\right]\right\} = 0$$

Resource constraint

$$Y_t = C_t + G_t^S + G_t^N$$

$$u_{c,t}\xi_t = \beta E_t u_{c,t+1}\xi_{t+1}(1-\tau_t^A)(1+i_t)\frac{P_t}{P_{t+1}}\frac{(1+\tau_t^s)}{(1+\tau_{t+1}^s)}$$

$$\frac{1-\tau_t^w}{1-\tau_t^s}\frac{W_t(j)}{P_t} = \frac{v_{l,t}}{u_{c,t}}$$

$$\{\sum_{T=t}^{\infty}(\alpha\beta)^{T-t}Q_{t,T}(1-\tau_T^P)(\frac{p_t^*}{P_T})^{-\theta-1}Y_T[\frac{p_t^*}{P_T}-\frac{\theta}{\theta-1}\frac{W_T(j)}{P_T}]\}=0$$

$$P_t = [(1-\alpha)(p_t^*)^{1-\theta} + \alpha P_{t-1}^{1-\theta}]^{\frac{1}{1-\theta}}$$

$$Y_t = C_t + G_t^S + G_t^N \qquad i_t \geq 0$$

$$\{Y_t, C_t, p_t^*, P_t\} - \{i_t, \tau_t^w, \tau_t^A, \tau_t^s, \tau_t^p, G_t^S, G_t^N\} - \{\xi_t\}$$

Summarizing the model

shock

AD $$\hat{Y}_t = E_t \hat{Y}_{t+1} - \sigma(i_t - E_t \pi_{t+1} - r^e(\xi_t)) + E_t(\hat{G}_t^N - \hat{G}_{t+1}^N) - \sigma E_t(\hat{\tau}_t^s - \hat{\tau}_{t+1}^s) + \sigma \hat{\tau}_t^A$$

AS $$\pi_t = \kappa \hat{Y}_t + \beta E_t \pi_{t+1} + \kappa \psi [\hat{\tau}_t^s + \hat{\tau}_t^w] - \kappa \psi \sigma^{-1} \hat{G}_t^N$$

ZB $$i_t \geq 0$$

$$r_t^e \equiv \log \beta^{-1} + \hat{\xi}_t - E_t \hat{\xi}_{t+1}$$

Baseline policy

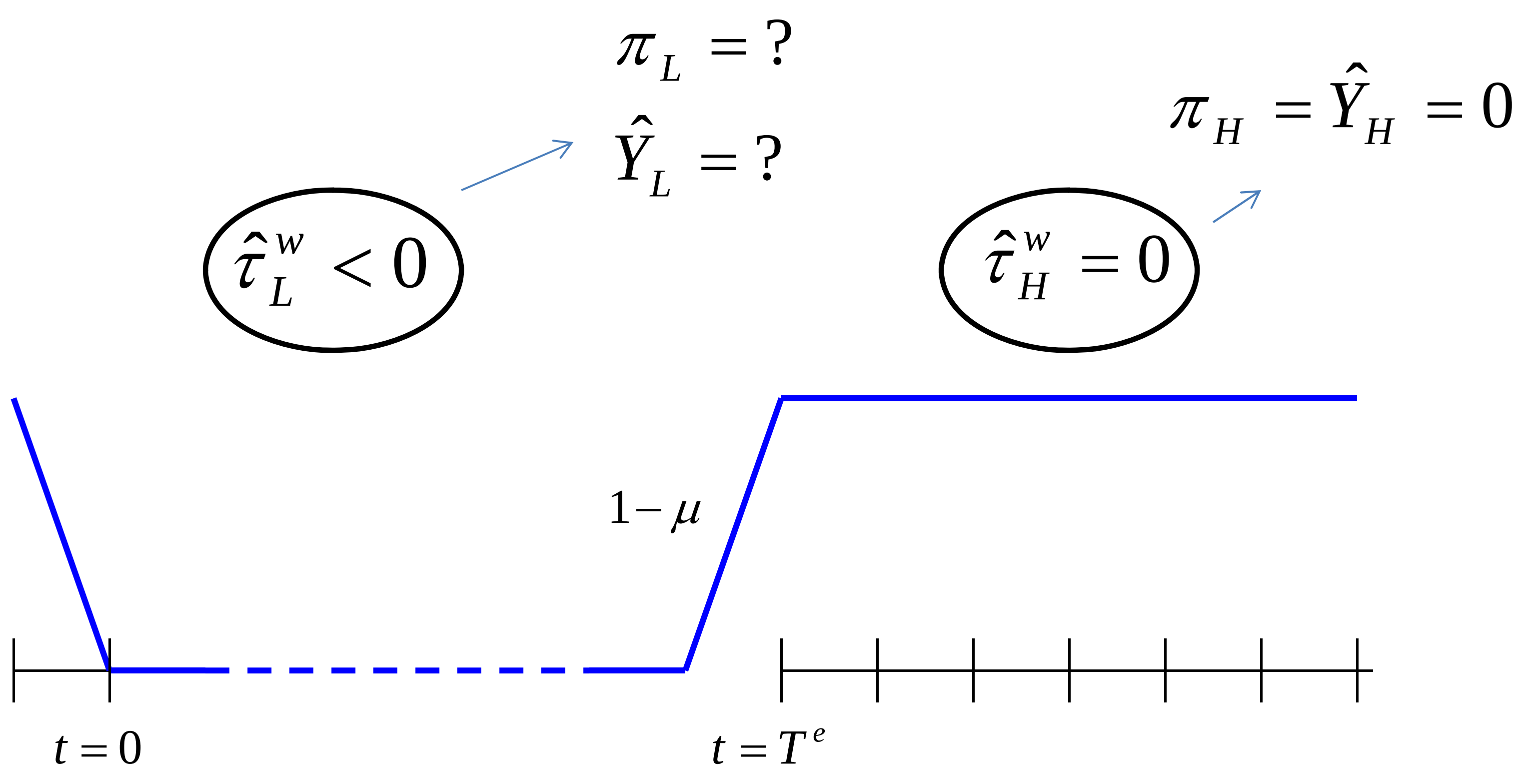
$$i_t = \max(0, r_t^e + \phi_\pi \pi_t + \phi_y \hat{Y}_t)$$

$$\hat{G}_t = 0 \text{ and } \hat{\tau}_t^s = \hat{\tau}_t^w = \hat{\tau}_t^p = \hat{\tau}_t^A = 0$$

Emphasis here:
Policy on the *margin*, i.e. "multipliers"
Well defined "benchmark" and study perturbations from this benchmark
Will not talk about optimal policy
e.g. Ramsey or Markov Perfect allocations

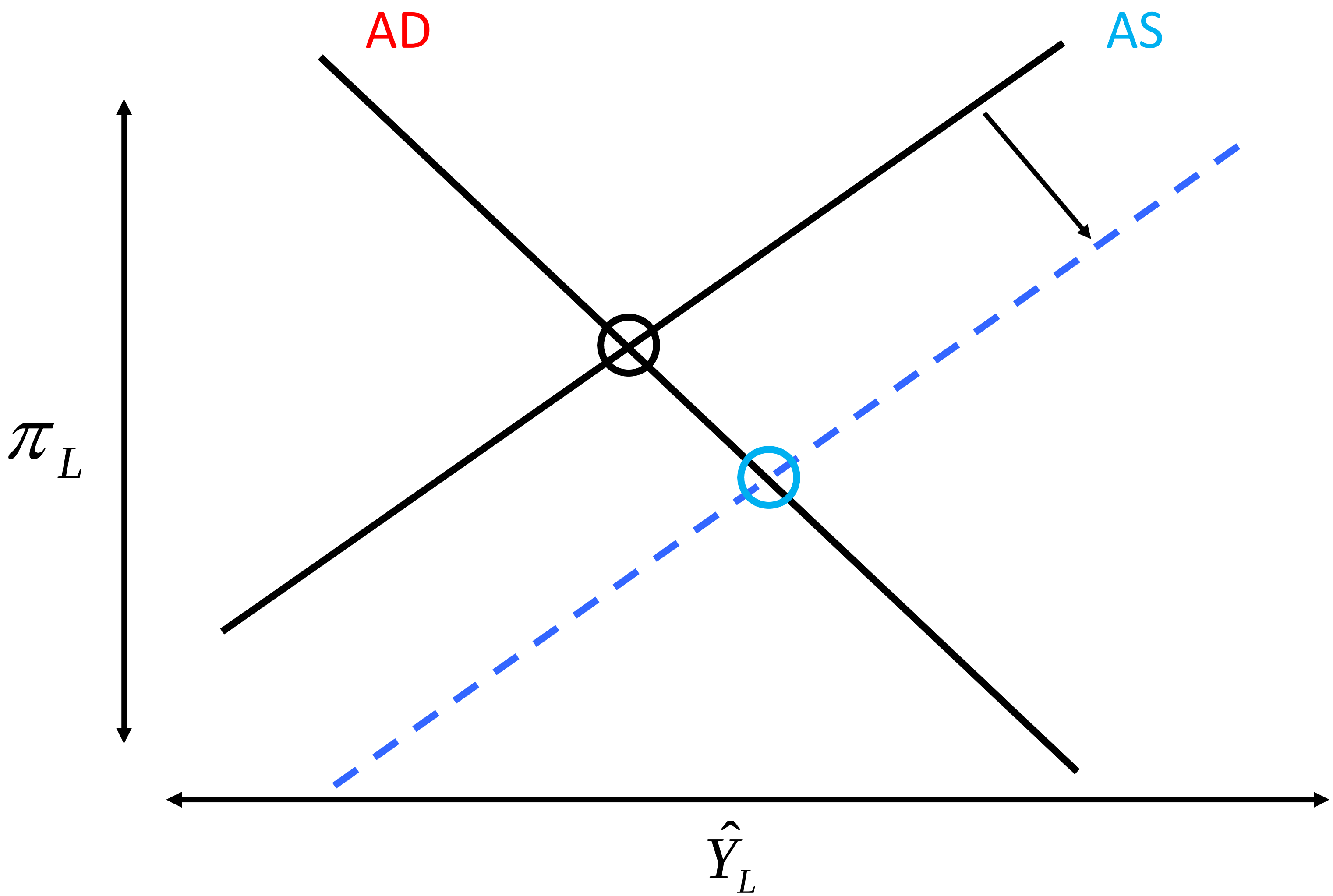
Effect of labor income tax cuts: Standard when no shocks

Experiment: Consider a temporary tax cuts that are reversed with probability 1-μ



AD $\hat{Y}_L = (1-\mu)\hat{Y}_L - \sigma(i_L - \pi_L)$ $\rightarrow$ $\hat{Y}_L = -\sigma\dfrac{\phi_\pi - \rho}{1-\rho+\sigma\phi_y}\pi_L$

AS $\pi_L = \kappa\hat{Y}_L + \kappa\psi\hat{\tau}_L^w + (1-\mu)\beta\pi_L$

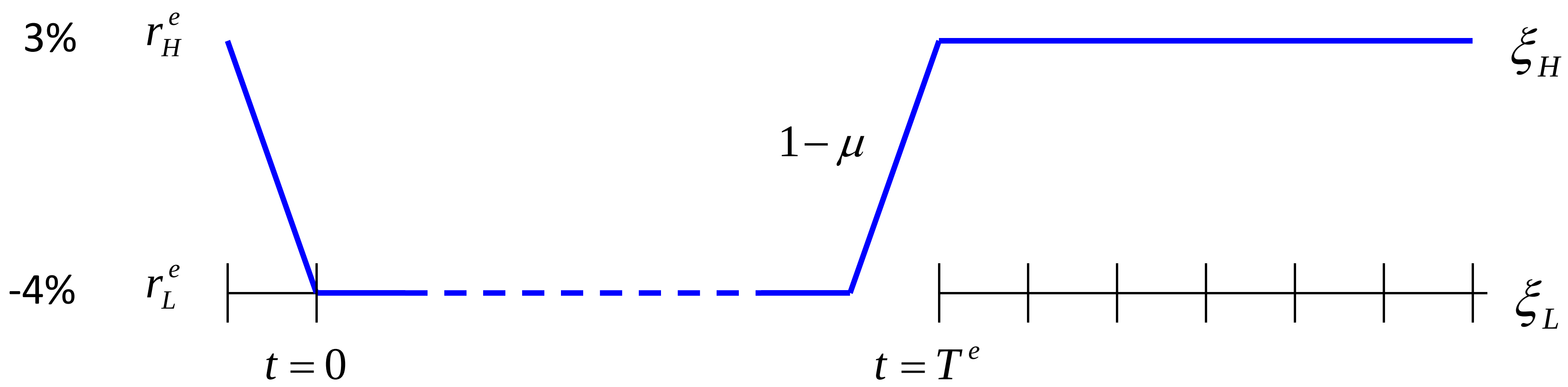


Under regular circumstances

- "Standard" intuition applies
- 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)

The source of the contraction
(Great Depression, crisis of 2008)

Structural Shocks (need this to explain a simultaneous fall in interest rates prices and output in this framework).



$$r_H^e = \bar{r} = \beta^{-1} - 1$$

$$r_L^e = \bar{r} + \mu\hat{\xi}_L < 0$$

- Preference shocks: Reduced form for anything that means that interest rate needs to decline to clear the market (e.g. banking problems, Curdia and Eggertsson (2009))
- Everybody want to spend less today relative to tomorrow.

Solution:

Boils down to only two equations! In two unknowns!

$$\left.\begin{aligned} \hat{Y}_L &= \mu \hat{Y}_L + \sigma\mu\pi_L + \sigma r_L^e \\ \pi_L &= \kappa \hat{Y}_L + \mu\beta\pi_L \end{aligned}\right\} t < T^e$$

Purely forward looking

For t $\geq T^e$

$$\hat{Y}_H = \pi_H = 0$$

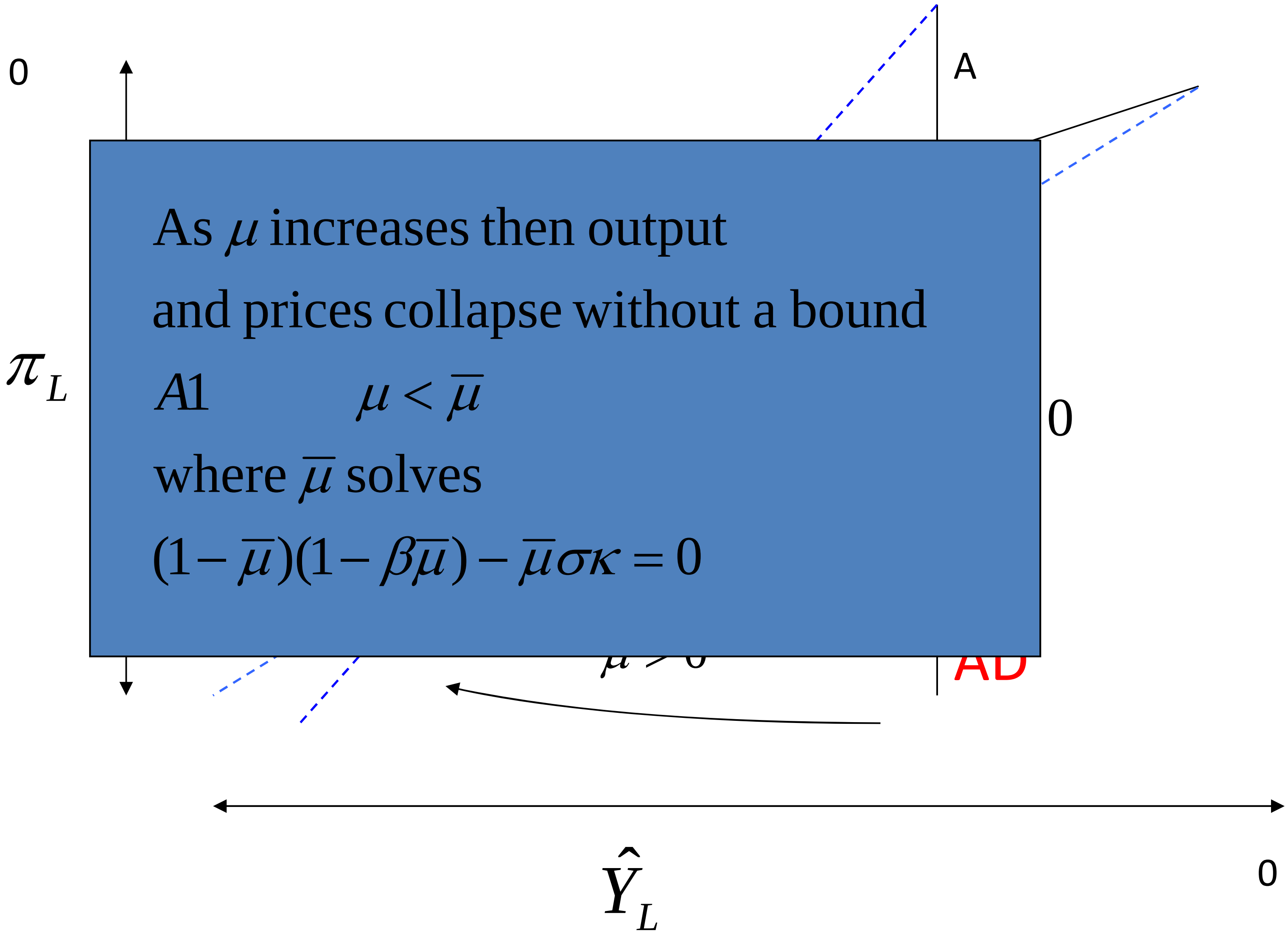
For t $< T^e$

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

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

and $i_t = 0$

AS $\pi_L = \kappa \hat{Y}_L + \mu\beta\pi_L$ AD $\hat{Y}_L = \mu\hat{Y}_L + \sigma\mu\pi_L + \sigma r_L^e$



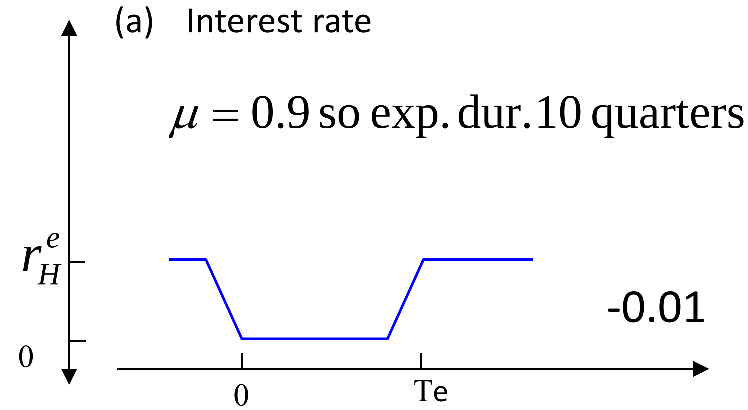
As μ increases then output and prices collapse without a bound

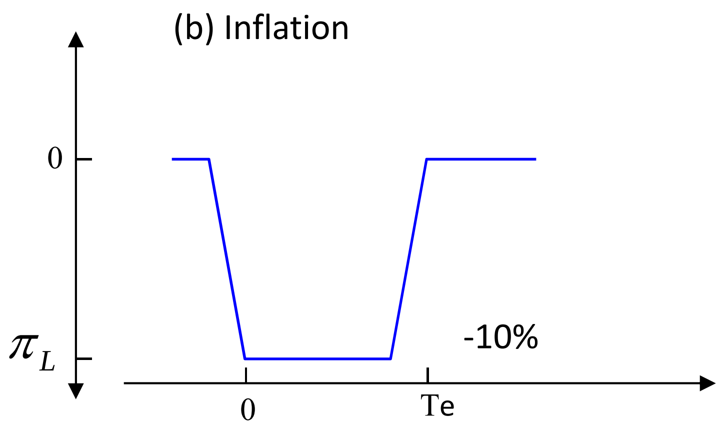
$$A1 \qquad \mu < \overline{\mu}$$

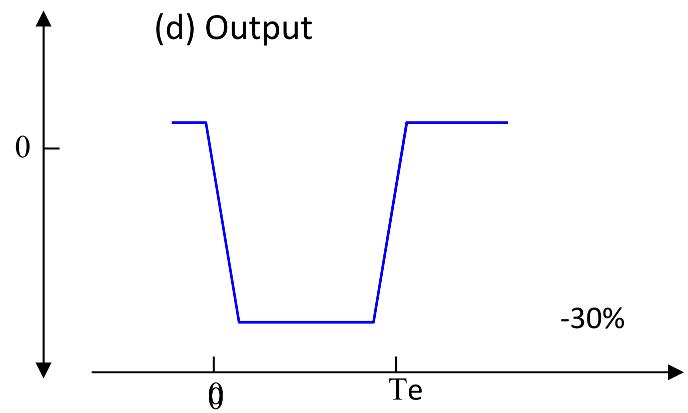
where $\overline{\mu}$ solves

$$(1-\overline{\mu})(1-\beta\overline{\mu}) - \overline{\mu}\sigma\kappa = 0$$

Output collapse







Why output collapse?

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

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

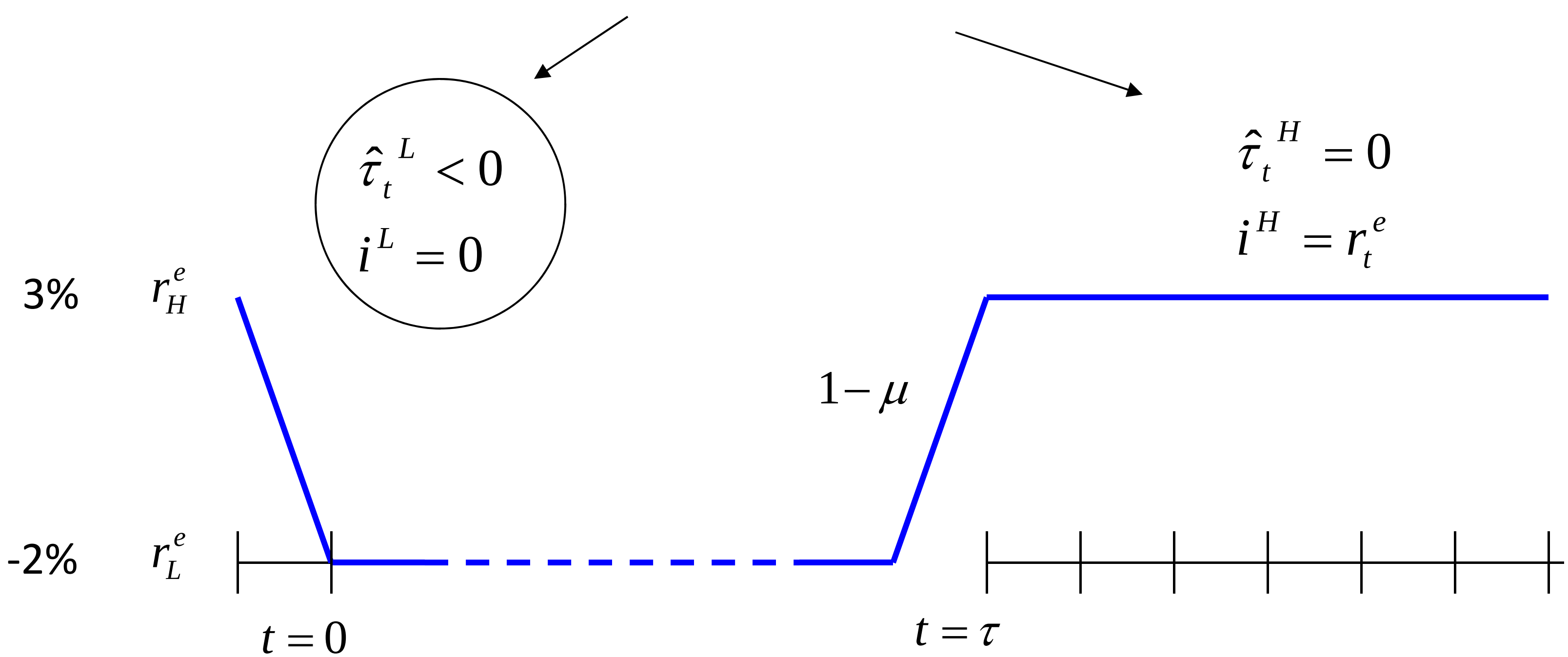
Contractionary Taxes

$$\hat{\tau}_L^w = \phi_\tau r_L^e < 0 \text{ for } 0 < t < T^e$$

$$\text{for t} \geq T^e$$

$$\hat{\tau}_L^w = \hat{Y}_t = \pi_t = 0$$

Basic policy analyzed: "Stimulus package"



Solution:

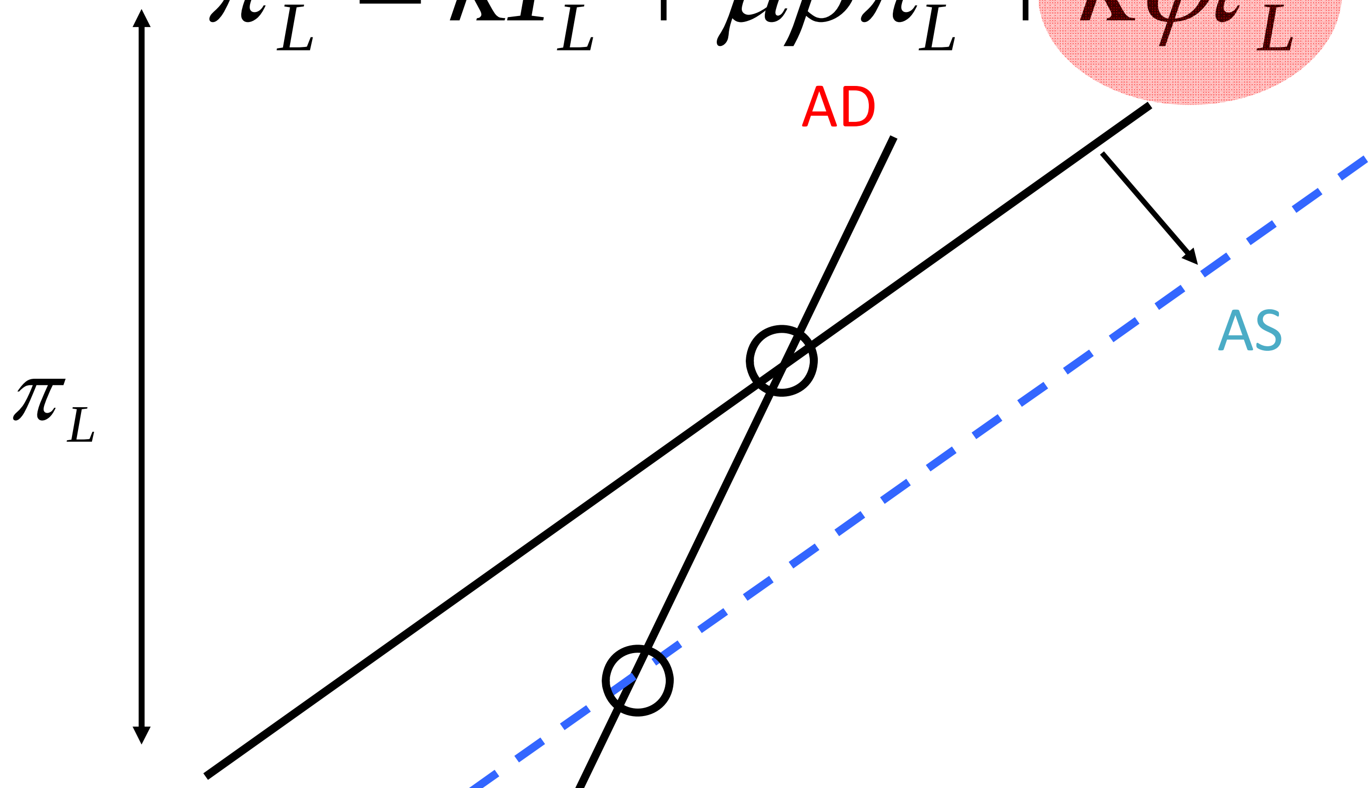
Again boils down to only two equations!

$$\left.\begin{aligned}\hat{Y}_L &= \mu\hat{Y}_L + \sigma\mu\pi_L + \sigma r_L^e \\ \pi_L &= \kappa\hat{Y}_L + \mu\beta\pi_L + \kappa\varphi\hat{\tau}_L^w\end{aligned}\right\} \quad t < \tau$$

- For a given taxes, two equations in two unknowns

$$\hat{Y}_L = \mu \hat{Y}_L + \sigma\mu\pi_L + \sigma r_L^e$$

$$\pi_L = \kappa\hat{Y}_L + \mu\beta\pi_L + \kappa\varphi\hat{\tau}_L$$



Note: under alternative pricing assumption, Lucas Phillips curve, sticky wages, menu cost models, still upward sloping FE curve.

Note: More flexible prices, steeper FE curve → result even stronger

Labor tax cuts are contractionary

$$\frac{\Delta Y_L}{-\Delta \tau_L} = \frac{\mu\kappa\psi}{(1-\mu)(1-\beta)-\mu\sigma\kappa} = -0.71 < 0$$

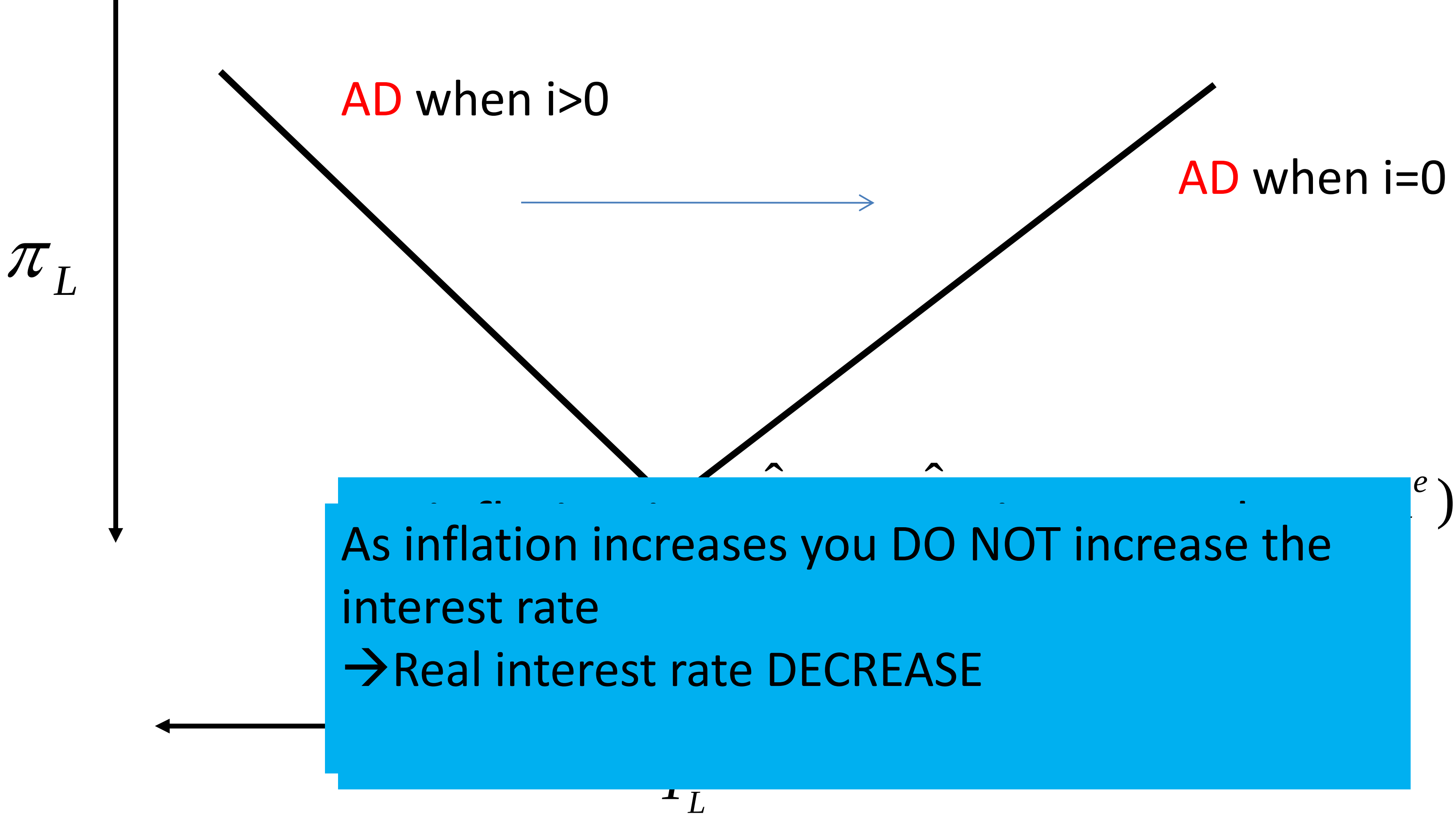
Intuition

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

	Payroll tax cut multiplier	Gov spending multiplier
Positive interest rate	0.096	0.32
Zero interest rate	-0.81	2.27

$$\hat{Y}_L = -\sigma i_L = -\sigma\phi_\pi \pi_L - \sigma\phi_y \hat{Y}_L \qquad \hat{Y}_L = -\frac{\sigma\phi_\pi}{1+\sigma\phi_y}\pi_L$$

$$\hat{Y}_L = \mu \hat{Y}_L + \sigma\mu\pi_L + \sigma r_L^e$$



As inflation increases you DO NOT increase the interest rate
→Real interest rate DECREASE

Discussion: 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] . Classic paradox of composition.

-- Tax story: No spending effect. Is that realistic?

Perhaps not under regular circumstances, but not clear if people will spend tax cuts.

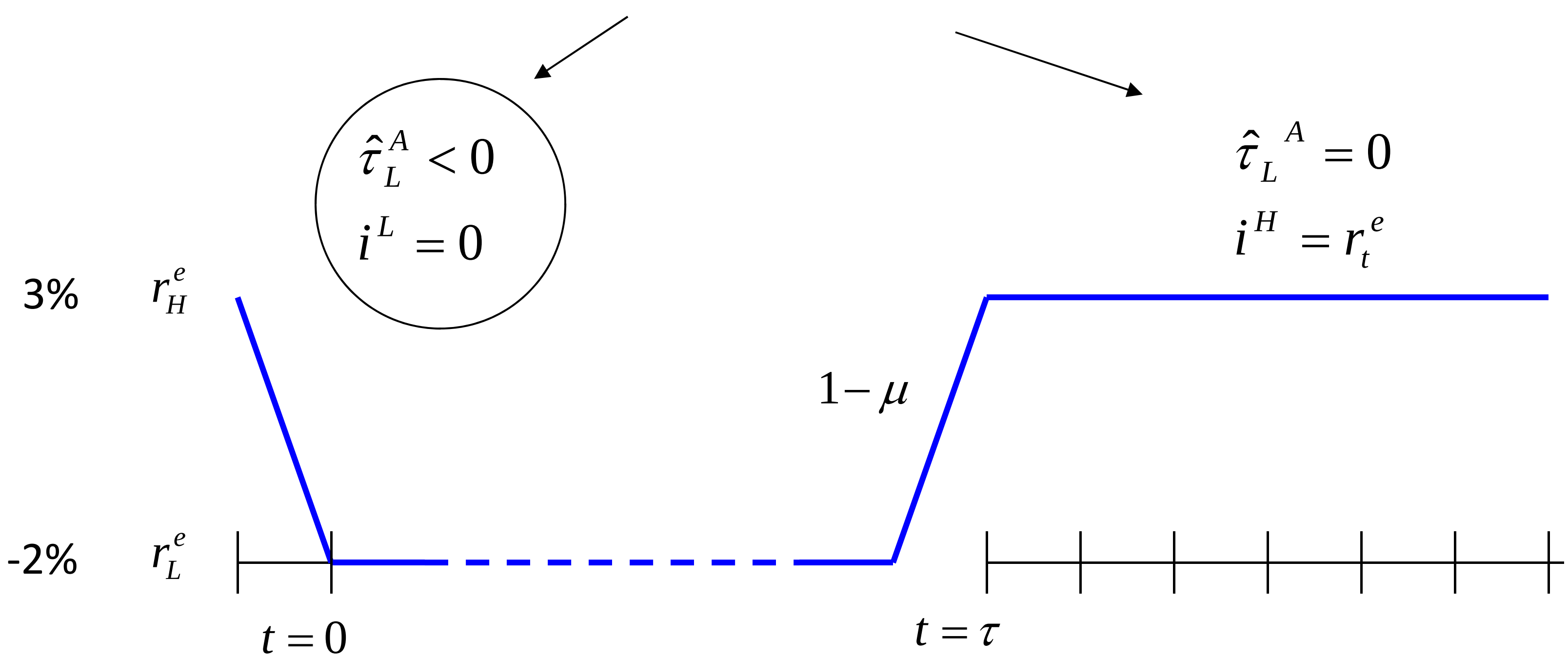
-- Extension: "Rule of thumb consumers" a Gali et al.

A fraction of consumers spend all their income.

-- Horse race: Who wins? The contractionary effect. "Direct spending effect" weakens the effect (lowers the interest rate elasticity of output) but does not overturn it under plausible calibration (need crazy values).

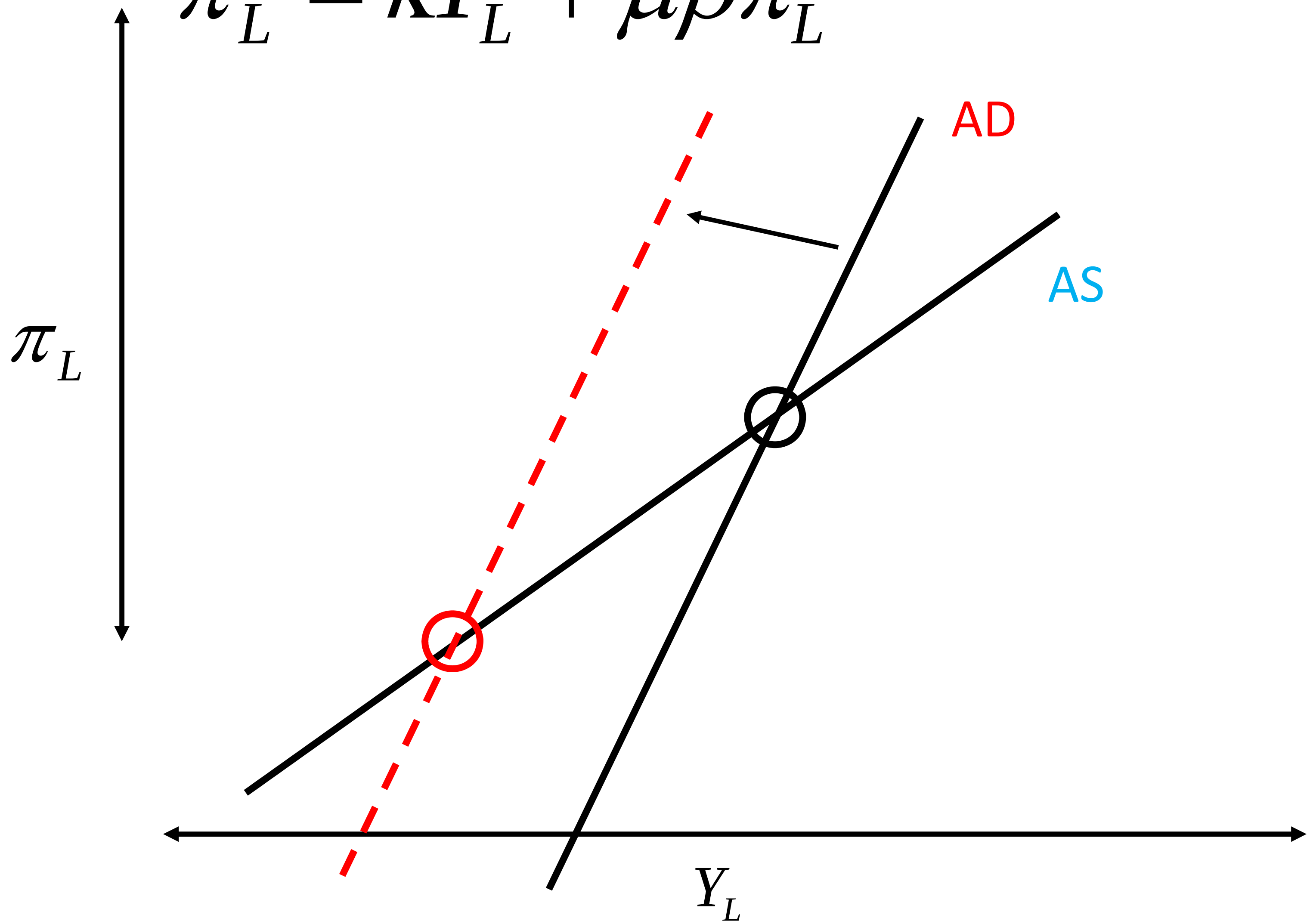
-- Another issue: Cochrane (2008) suggests that current tax cuts in fact increase effective marginal taxes. This would be ideal!

Basic policy analyzed:
"Stimulus package II"
Cut taxes on capital



$$\hat{Y}_L = \mu\hat{Y}_L + \sigma\mu\pi_L + \sigma r_L^e + \sigma\tau_t^A$$

$$\pi_L = \kappa\hat{Y}_L + \mu\beta\pi_L$$



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	0.096	-0.0033
Zero interest rate	-0.81	-0.4048

Plan

1. Basic model, key result – contractionary labor and capital tax cuts
2. Other demand and supply policies
   i. a. expansionary government spending
      b. irrelevant government spending
   ii. sales tax cuts
   iii. Cutting taxes on profits and investment tax credit
   iv. monetary policy
3. Quantitative evaluations
4. Conclusions

2(i.a) Expansionary Government Spending

$$\max \; E_t \sum_{T=t}^{\infty} \beta^{T-t} \left[u(C_T + G_T^S) + g(G_T^N) - \int_0^1 v(L_T(j))\,dj \right] \xi_T$$

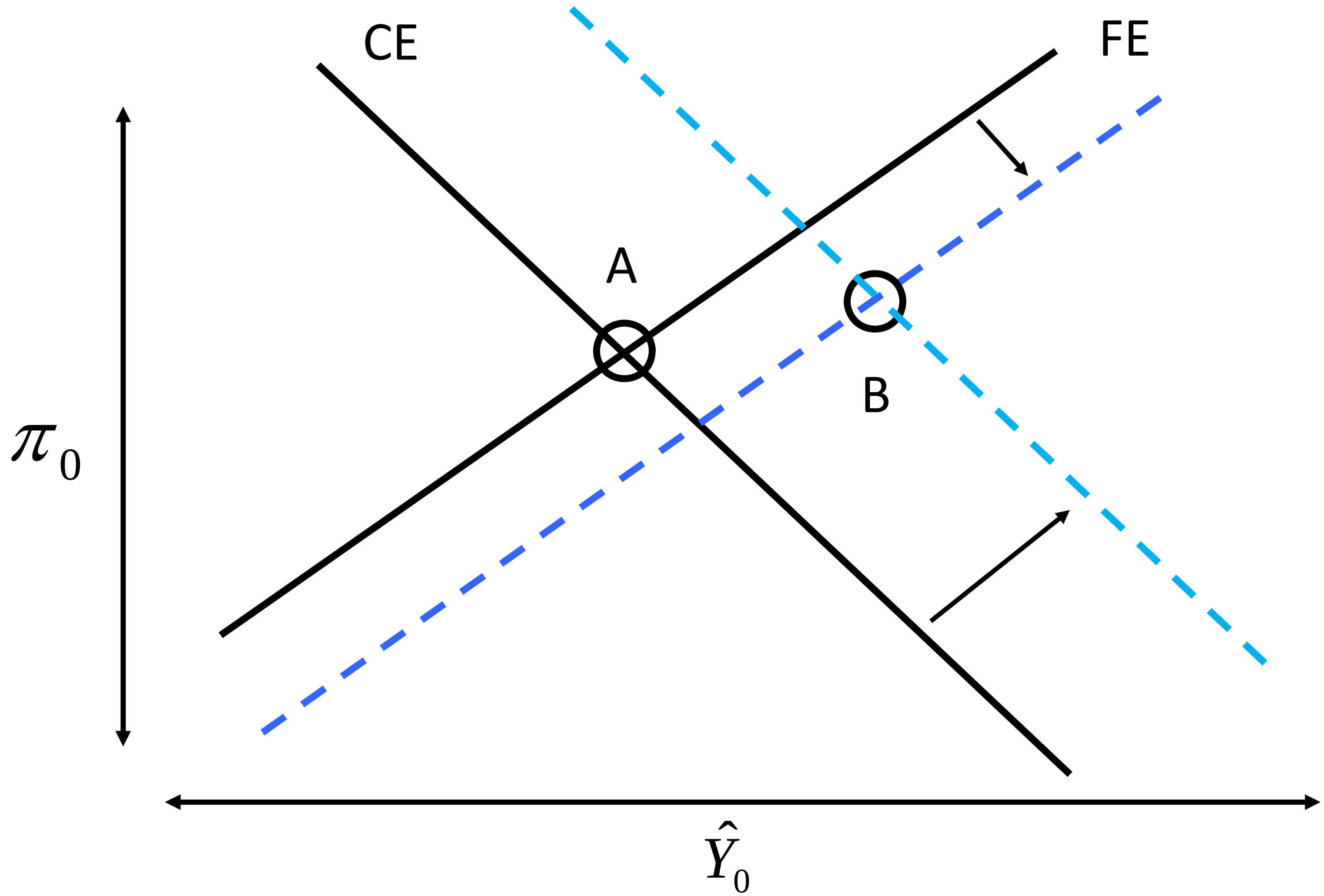
$$\hat{G}_L^N = \phi_G r_L^e > 0 \;\; \text{for} \;\; 0 < t < T^e$$

$$\text{for t} \geq T^e$$

$$\hat{G}_t^N = \hat{Y}_t = \pi_t = 0$$

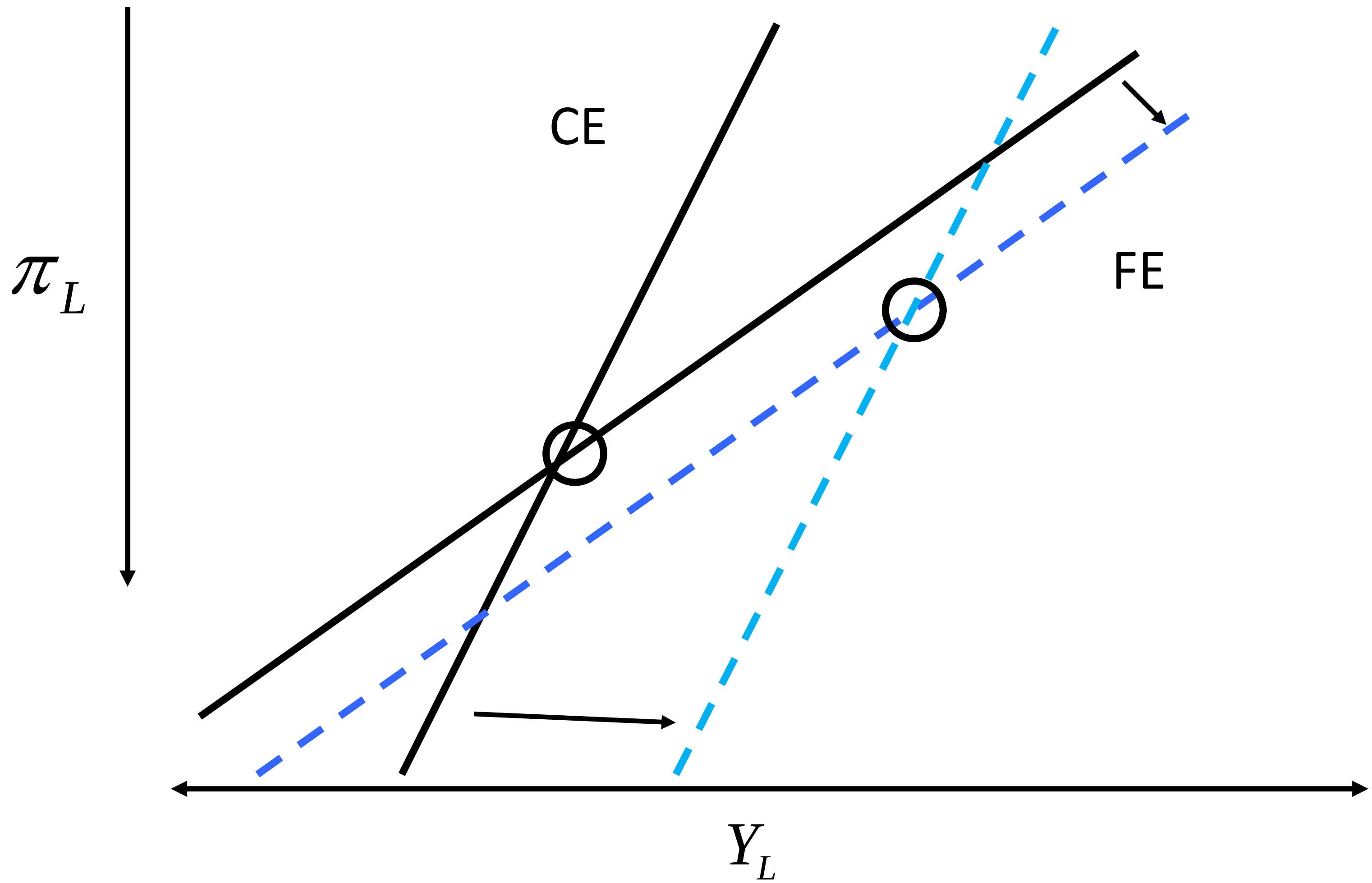
CE $\quad \hat{Y}_L = \sigma i_L + \hat{G}_L = \sigma\phi_\pi \pi_L + \sigma\phi_y \hat{Y}_L + \hat{G}_L \quad$ AD

FE $\quad \pi_L = \kappa\hat{Y}_L + \kappa\psi\hat{\tau}_L - \kappa\psi\sigma^{-1}\hat{G}_L \quad$ AS



$$\hat{Y}_L = \mu \hat{Y}_L + \sigma \mu \pi_L + \sigma r_L^e + (1-\mu)\hat{G}_L$$

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



Spending is Expansionary

$$\frac{\Delta Y_L}{\Delta G_L^N} = \frac{(1-\mu)(1-\beta\mu)-\mu\kappa\psi}{(1-\mu)(1-\beta)-\mu\sigma\kappa} = 2.27 > 1$$

- Intuition

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

	Payroll tax multiplier	Gov spending multiplier
Positive interest rate	0.0963	0.32
Zero interest rate	-0.8153	2.28

Implications

- Can show that spending increases welfare, even if it contributes nothing to utility
- Digging ditches and filling them up.
- Regular cost benefits analysis does not apply to public spending.
- Even better if government spending actually adds to utility.
- Not crucial if delay: Expectation doing most of the work [relevant for “Obama stimulus”.]
- Needs to be explicitly “temporary” and last as long as “the emergency”.
- Government spending that simultaneously increases “aggregate spending”, and reduces “aggregate supply” has biggest effect. War? Not really (does not correlate perfectly with emergency)
- Why different from some recent studies? Counterfactual.

2(i.b) Irrelevant government spending

"In the end, despite the existence of idle resources, bailouts and stimulus plans do not add to current resources in use. They just move resources from one use to another." Eugene Fama. Also see also Cochrane (2008) and Barro (2009).

$$\max E_t \sum_{T=t}^{\infty} \beta^{T-t} \left[u(C_T + G_T^S) + g(G_T^N) - \int_0^1 v(L_T(j))\,dj \right] \xi_T$$

Proposition: Increasing G_T^S has no effect on aggregate output or inflation.

People reduce private spending one to one with public spending
Both AS and AD equation unchanged
Spending just "remove resources from one use to another".

Health care an example of irrelevant spending (although could increase demand by increasing expectation of future productivity)

	Payroll tax multiplier	Gov spending multiplier 1	Gov spend multiplier 2
Positive interest rate	0.096	0.32	0
Zero interest rate	-0.81	2.27	0

2. (ii) Sales tax cut

- Sales taxes shows up as:

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

$$\pi_t = \kappa \hat{Y}_t + \beta E_t \pi_{t+1} + \kappa \psi (\hat{\tau}_t^w + \hat{\tau}_t^s)$$

Note shows up as Government Spending but multiplied with sigma! Same effect
Consider this policy:

$$\hat{\tau}_t^s = -\hat{\tau}_t^w = \sum_{T=t}^{\infty} E_t [r_T^e - \bar{r}]$$

- Revenue neutral policy: Increase payroll taxes and cut sales taxes. Can eliminate the recession in the model. Problem: Tax rates cannot be reduced enough, would require consumption subsidy.
- Note VAT does now show up in this fashion! Eggertsson and Woodford (2004)

	Payroll tax multiplier	**Gov spending multiplier 1**	**Gov spend Multiplier 2**	**Sales tax Multiplier**
i>0	0.096	0.32	0	0.37
i=0	-0.8153	2.28	0	2.64

2. (iii) Capital taxes and investment tax credit, paradox of thrift

- Consider a model with capital and an adjustment cost function so that to increase capital stock from K(t) to K(t+1) one must pay

$$I_t = \phi\left(\frac{K_{t+1}(i)}{K_t(i)}, \xi_t\right) K_t(i)$$

- Assume capital income taxes, and also an investment tax credit.

$$\Pi_t(i)^{precaptax} = p_t(i) y_t(i) - P_t w_t(i) l_t(i) - P_t I_t$$

- Capital tax bill

$$\tau_t^p [p_t(i) y_t(i) - P_t w_t(i) l_t(i) - (1 + \tau_t^I) P_t I_t(i)]$$

2. (iii) Capital taxes and investment tax credit.

We get a second Euler Equation

$$\hat{I}_t^N = \beta E_t \hat{I}_{t+1}^N - \sigma_I (i_t - E_t \pi_{t+1} - r_t^e - \hat{\tau}_t^A) + \chi E_t \hat{\rho}_{t+1}$$

$$+ \frac{\bar{\tau}^P}{1-\bar{\tau}^P} E_t[\hat{\tau}_t^I - \beta(1-\lambda)\hat{\tau}_{t+1}^I] + E_t[\hat{\tau}_t^P - \beta(1-\lambda)\hat{\tau}_{t+1}^P] - E_t[\hat{\tau}_t^S - \beta(1-\lambda)\hat{\tau}_{t+1}^S]$$

$$\hat{\rho}_t = (1+\nu)\hat{L}_t + \sigma^{-1}\hat{C}_t - \hat{K}_t + \hat{\tau}_t^s + \hat{\tau}_t^w - \hat{\tau}_t^p$$

Basic results: Previous results unaffected by endogenous capital accumulation (quantitatively and qualitatively).

Temporary capital tax cuts are contractionary (tau_p and tau_a, -0.44, -0.467).

Investment credit is expansionary.

Investment tax credit multiplier: 0.33

Paradox of thrift: 1% cut in capital taxes (higher incentive to save) lowers investment by 0.44%

Why does cutting taxes on profits reduce output?

- Cutting taxes on profits today (so that they are expected to increase in the future) gives firms the incentive to *delay investment*, because they want to pay out as much profits as the can today. → Reduces investment
- This is also true at positive interest rates (similar results found by Auerbach and Summers in the 1980's).
- Observe, here the assumption of *temporary tax* cuts important.
- Not what Barro (2009) has in mind.
- Also note: No feedback between stock prices and ability to borrow (channel emphasized by Feldstein (2008)).

2. (iv): 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,

- show in paper that 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].
- AER article mostly about how FDR made a policy of reflation "credible".

3. Quantitative evaluation

- Constrained by computational issues, non-linearity of zero bound prohibits estimation of the model (in any case too simple as stands).
- Not even clear if a formal estimation of the model would be helpful. These scenarios are “rare” and only one example in the sample (Great Depression)
- Want model to match a “hypothetical scenario”.
- Formulate “what if” question: Shocks “such that” output is -30 percent, deflation of order -10 percent.
- Calibrate parameters using priors.

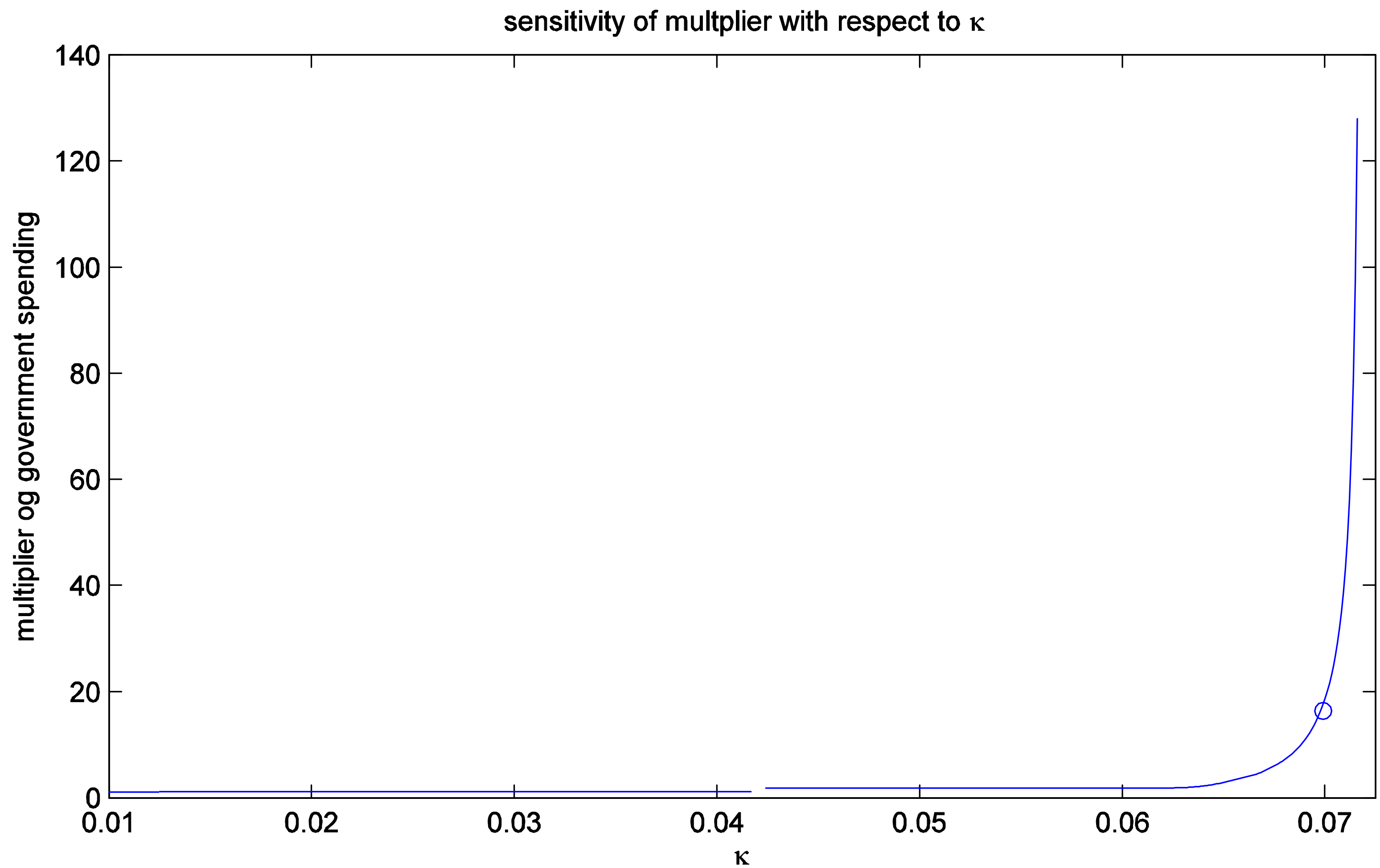
Simple closed for solutions

$$\hat{Y}_L = \frac{1}{(1-\mu)(1-\beta\mu)-\mu\sigma\kappa}\kappa\sigma r_L^e < 0$$

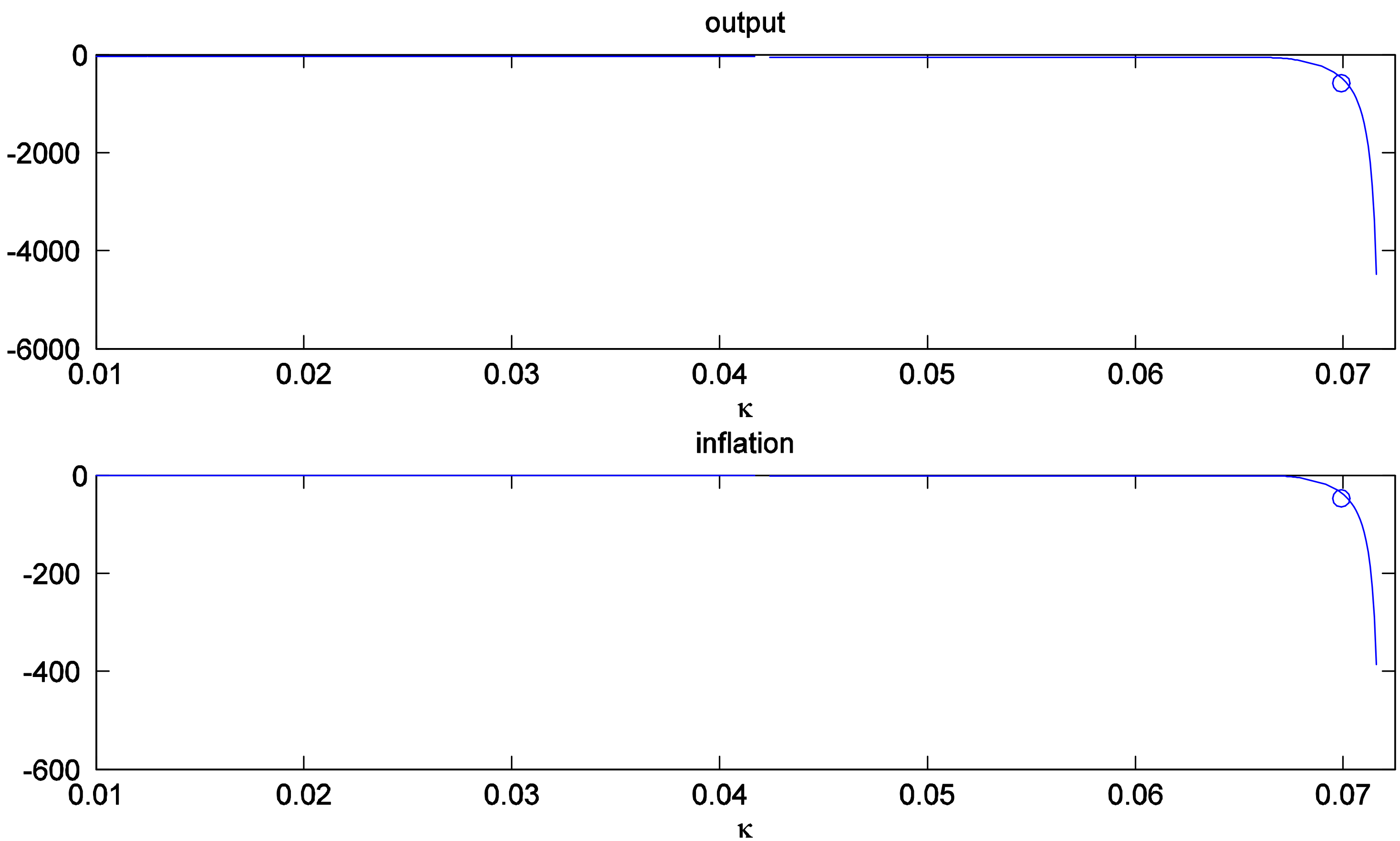
$$\pi_L = \frac{1-\beta\mu}{(1-\mu)(1-\beta\mu)-\mu\sigma\kappa}\sigma r_L^e < 0$$

$$\frac{\Delta Y_L}{\Delta G_L^N} = \frac{(1-\mu)(1-\beta\mu)-\mu\kappa\psi}{(1-\mu)(1-\beta)-\mu\sigma\kappa} = 2.27 > 1$$

Calibration approach



Large multipliers apply only as we approach what Krugman calls "deflationary blackholes"



My approach

- Formulate “what if” question: Shocks “such that” output is -30 percent, deflation of order -10 percent.
- Calibrate parameters using priors.

- Only reported "mode". Of what?

$$\hat{Y}_t^{\text{model}} = \hat{Y}_t^{\text{data}} + \varepsilon_t$$

$$\pi_t^{\text{model}} = \pi_{\mathrm{t}}^{\text{data}} + v_t$$

Measurement error

- Form priors of parameters based on other data. Update priors to match calibrated target's . Minimize

$$L = \frac{(\hat{Y}_L^{\text{model}} - \hat{Y}_L^{\text{target}})^2}{2\sigma_\varepsilon^2} + \frac{(\pi_L^{\text{model}} - \pi_{\mathrm{L}}^{\text{target}})^2}{2\sigma_v^2} + \sum f(\Omega)$$

Priors

Choose $\hat{Y}_t^{\text{data}} = -30\%$ $\pi_{\mathrm{t}}^{\text{data}} = -10\%$

Characterize L by using Metrapolis algorithm measurement error, $\sigma_\varepsilon = \sigma_v = 10\text{^}{-6}$

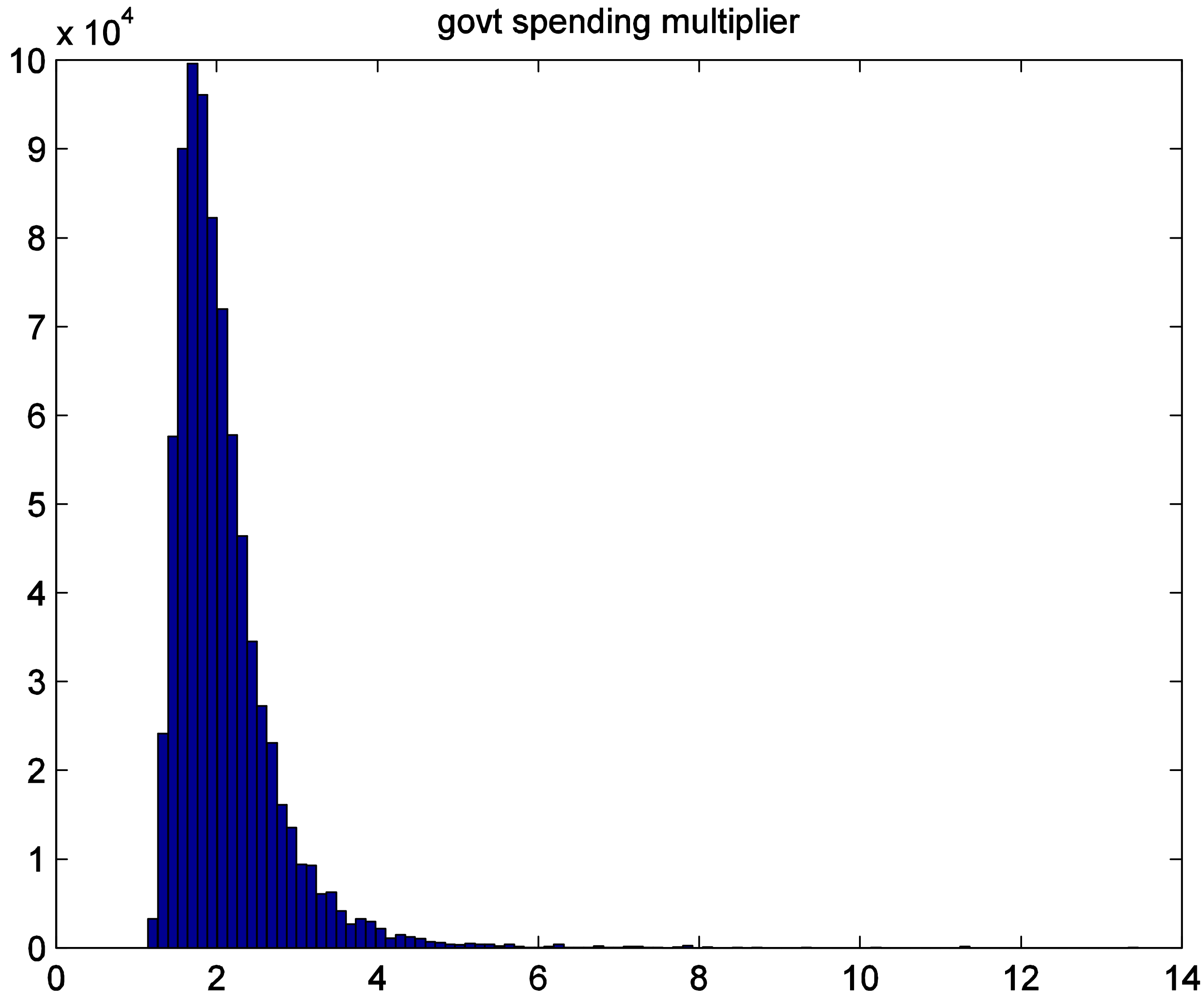
Priors and posteriors

	Prior 5%	Prior 50%	Prior 95%	Posterior 5%	Posterior 50%	Posterior 95%	Mode
alpha	0.5757	0.6612	0.7402	0.7026	0.7633	0.8164	0.7747
beta	0.9949	0.9968	0.9981	0.9948	0.9967	0.9981	0.9970
1-mu	0.0198	0.0740	0.1788	0.0705	0.1045	0.1523	0.0971
omega	0.1519	0.8200	2.4631	0.7756	1.9033	3.8332	1.5692
reL	-0.0196	-0.0094	-0.0036	-0.0266	-0.0146	-0.0066	-0.0104
sigma^-1	1.2545	1.9585	2.8871	0.8107	1.2161	1.7779	1.1599
theta	3.7817	7.6283	13.4871	8.3394	13.2496	19.7410	12.7721

	alpha	beta	gamma	sigmainv	omega	theta	reL
alpha	1	-0.0115	-0.5595	0.4633	-0.1913	-0.4403	0.1770
beta	-0.0115	1	0.0319	-0.0157	-0.0091	0.0202	-0.0266
gamma	-0.5595	0.0319	1	-0.7517	-0.2389	-0.2506	-0.4121
sigmainv	0.4633	-0.0157	-0.7517	1	0.2803	0.2033	-0.2119
omega	-0.1913	-0.0091	-0.2389	0.2803	1	-0.0844	-0.0313
theta	-0.4403	0.0202	-0.2506	0.2033	-0.0844	1	0.0650
reL	0.1770	-0.0266	-0.4121	-0.2119	-0.0313	0.0650	1

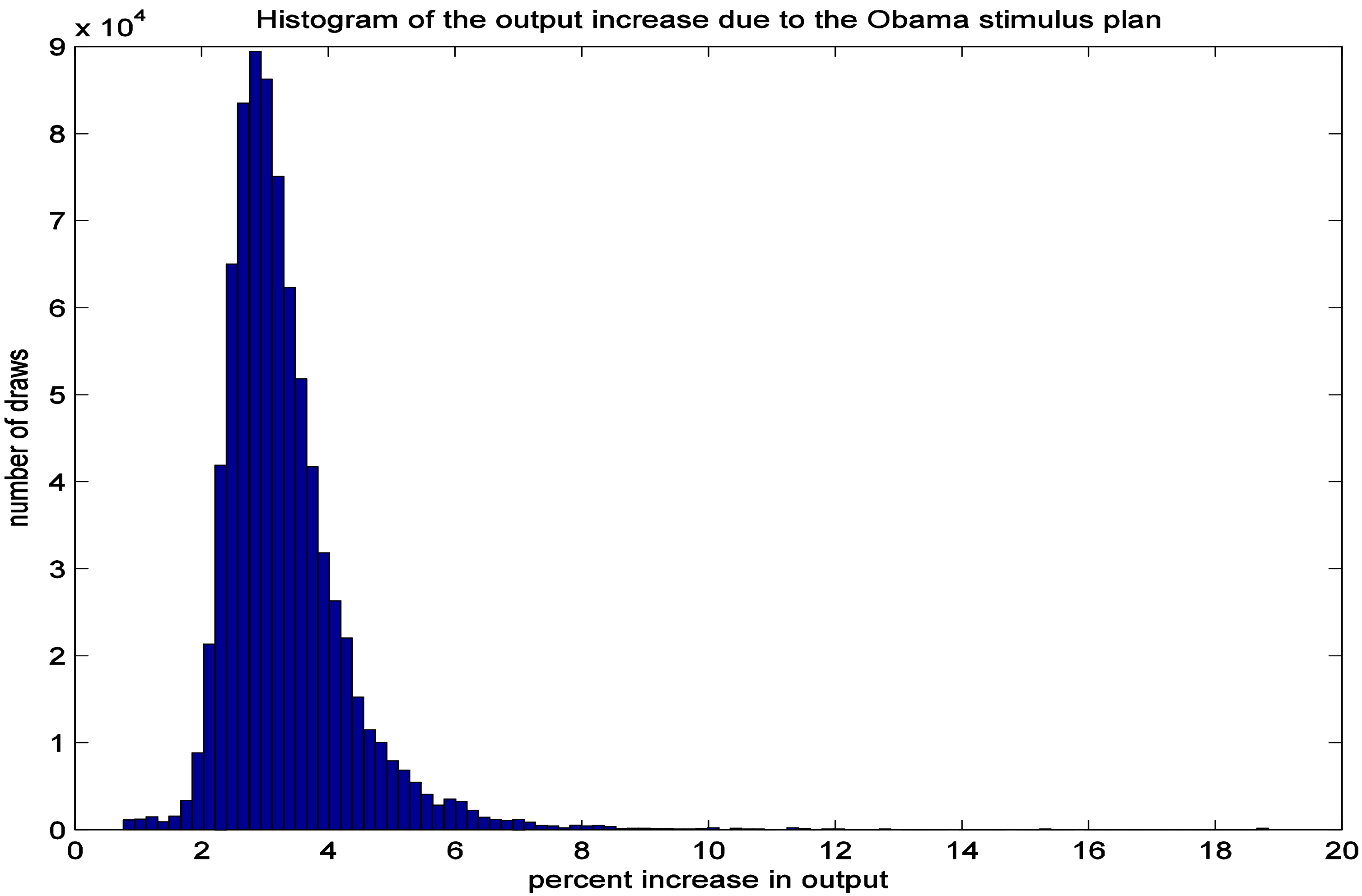
Multipliers

	Posterior 5%	Posterior 50%	Posterior 95%	Mode
tax cut multiplier i>0	0.0476	0.0800	0.1434	0.0962
tax cut multiplier i=0	-1.3890	-0.4994	-0.2132	-0.8153
gov spending multiplier i>0	0.2911	0.3428	0.4038	0.3247
gov spending multiplier i=0	1.4295	1.9258	3.2064	2.2793
sales tax cut multipler i>0	0.2541	0.4180	0.6578	0.3766
sales tax cut multipler i=0	1.4883	2.3851	4.1760	2.6438
capital tax cut multipler i>0	-0.0049	-0.0034	-0.0024	-0.0033
capital tax cut multipler i=0	-0.6748	-0.3031	-0.1605	-0.4048

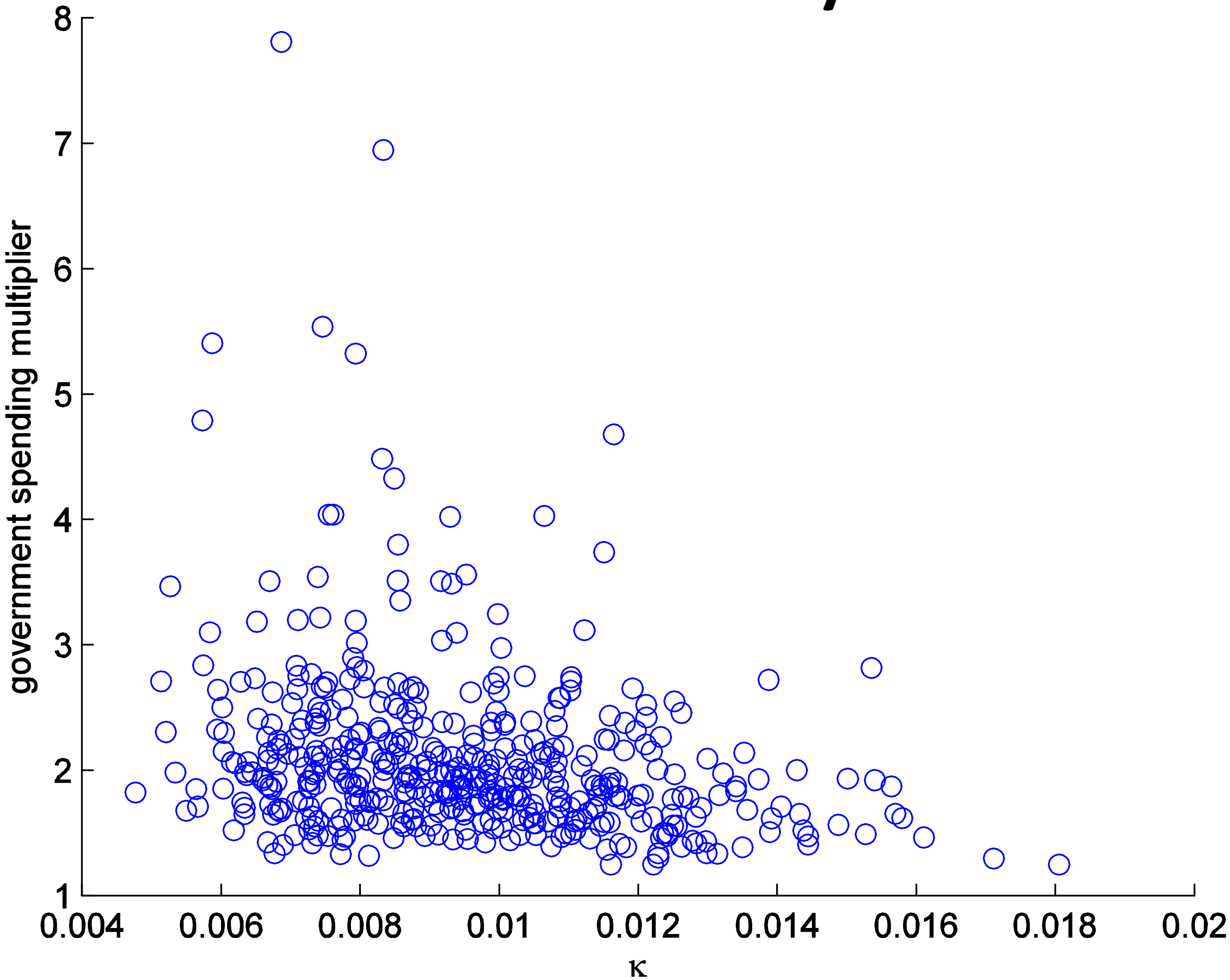


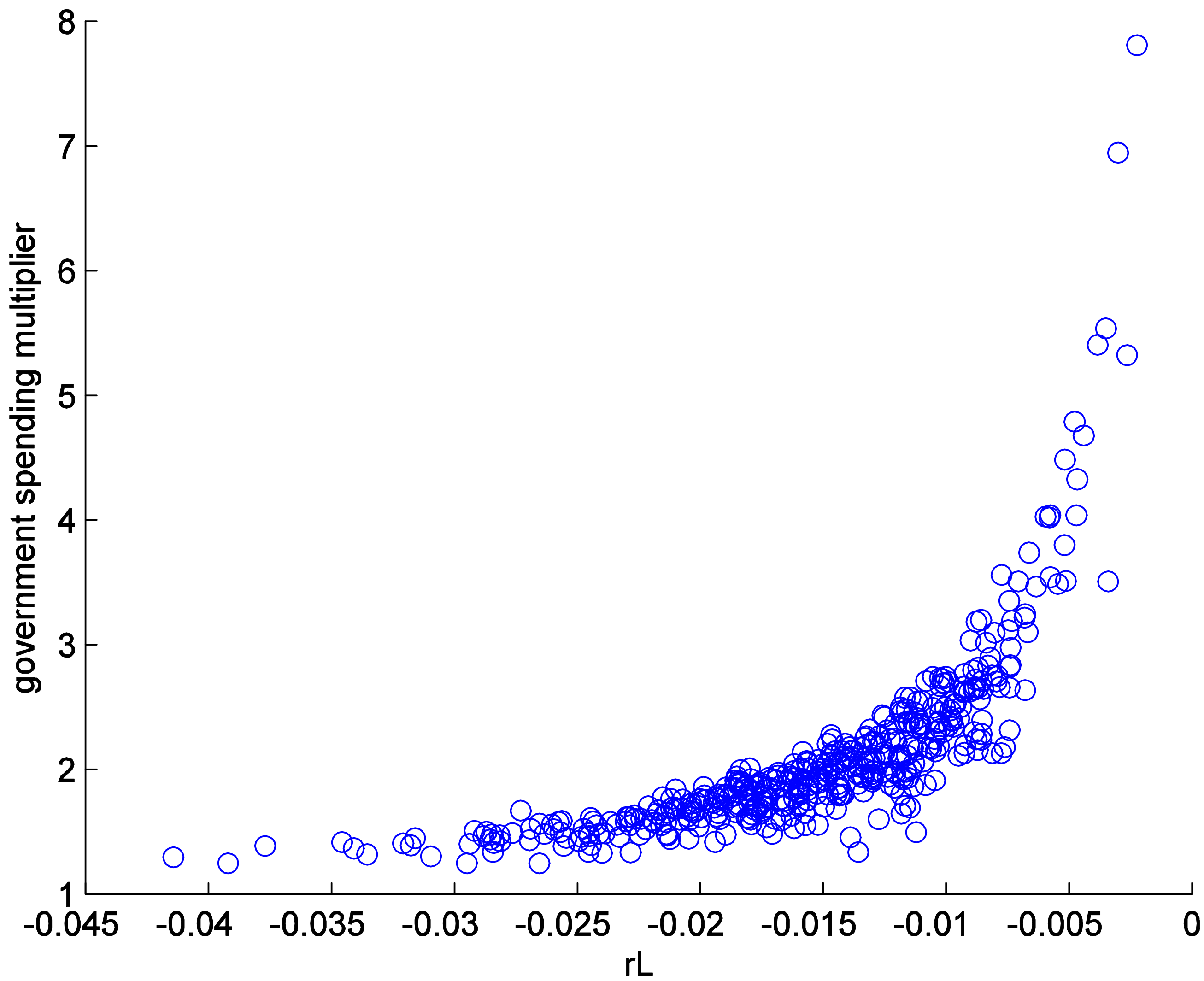
govt spending multiplier
x 10^4
10
9
8
7
6
5
4
3
2
1
0
0
2
4
6
8
10
12
14

What is the effect of the Obama stimulus plan on output ?



Sensitivity




government spending multiplier
8
7
6
5
4
3
2
1
-0.045
-0.04
-0.035
-0.03
-0.025
-0.02
-0.015
-0.01
-0.005
0
rL

Taylor et al

- Find tiny government sending multiplier. Why?
- Because assume *a permanent increase in spending*.

Key: Need to affect spending today, *<u>relative to the future</u>*.

shock

AD
$$\hat{Y}_t = E_t\hat{Y}_{t+1} - \sigma(i_t - E_t\pi_{t+1} - r_t^e) + E_t(\hat{G}_t^N - \hat{G}_{t+1}^N) - \sigma E_t(\hat{\tau}_t^s - \hat{\tau}_{t+1}^s) + \sigma\hat{\tau}_t^A$$

AS $$\pi_t = \kappa\hat{Y}_t + \beta E_t\pi_{t+1} + \kappa\psi[\hat{\tau}_t^s + \hat{\tau}_t^w] - \kappa\psi\sigma^{-1}\hat{G}_t^N$$

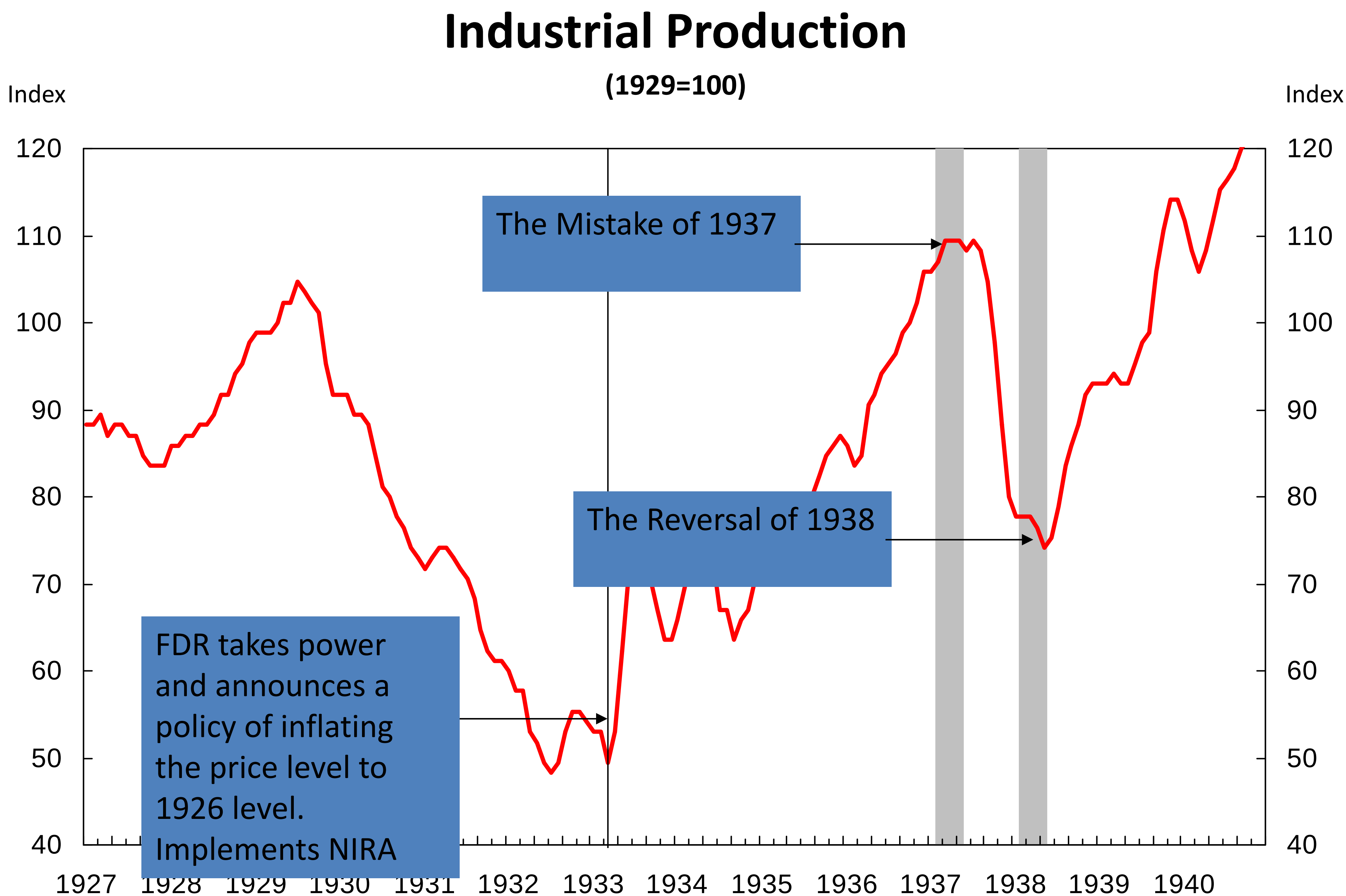
ZB $$i_t \geq 0$$

Conjecture: Permanent increase in G *<u>contractionary</u>*.

Was the New Deal Contractionary?

$$\pi_t = \kappa \hat{Y}_t + \beta E_t \pi_{t+1} + \kappa \varphi \hat{\omega}_t$$

- In the model, the National Industrial Recovery Act, shows up exactly like marginal tax increases
- Increase in monopoly power of firms and workers.
- Expansionary because it increases prices.
- A reduction/increase in oil prices has the same effect as variations in taxes.
- A reduction in oil prices is contractionary!
- Our current recession coincides with a collapse in oil prices
- VAR evidence from Japan (in progress)



Source: Federal Reserve Board

Was the New Deal Contractionary?

Comparison to Cole and Ohanian (2004)

Both stories "explain" actual output. Difference: Counterfactual

Eggertsson New Deal

Cole and Ohanian
New Deal

enchmark

Predictions:
This paper: Suggests that real interest rate should have declined 1933-37 to negative levels (key reason for recovery).
Cole and Ohanian story: Real interest rates should have been *high during the recovery*.

Conclusions

- 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.
- Should focus on government spending that is not substituting private spending.

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