EABCN TRAINING SCHOOL: MONETARY-FISCAL POLICY INTERACTIONS
LECTURE 7. EFFICACY OF FISCAL STIMULUS

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THEMES

- Monetary and fiscal policy responses to recession and financial crisis of 2007-2009 have been unusual aggressive
- United States, Japan, China, many European countries employed large "discretionary" fiscal stimulus packages
- Many central banks have driven interest rates to near zero and engaged in unconventional operations that have exploded their balance sheets
- This lecture pulls together themes of previous lectures to address potential consequences of these actions
  - interaction of monetary-fiscal policies
  - role of fiscal financing for policy effects
  - how fiscal foresight can affect short-run impacts of policy
  - regime switching in monetary and fiscal policies
- Draws on Leeper-Plante-Traum (2010), Leeper-Walker-Yang (2009), Davig-Leeper (2010)

THE MESSAGES

- Estimates of fiscal stimulus depend strongly on

    - how stimulus is implemented—tax cuts (which taxes); spending increases (which spending)

    - *how* and *when* the private sector expects the resulting debt expansion will be financed

    - whether the stimulus occurs gradually, so agents have fiscal foresight

    - how monetary policy behaves—whether it is active or passive

- Unfortunately, many of these considerations play little role in government projections of impacts of fiscal stimulus

THE U.S. EXAMPLE

- American Reinvestment and Recovery Act: \$787 Billion (5 % GDP)

- Financed with new government debt issuance

- Rationale provided by paper by Romer-Bernstein reporting

  - multipliers for permanent 1% of GDP increase in G and decrease in T

  - forecasts of unemployment rate with and with stimulus

  - claim GDP will be 3.7% higher; 3.6 million new jobs

ROMER-BERNSTEIN MULTIPLIERS
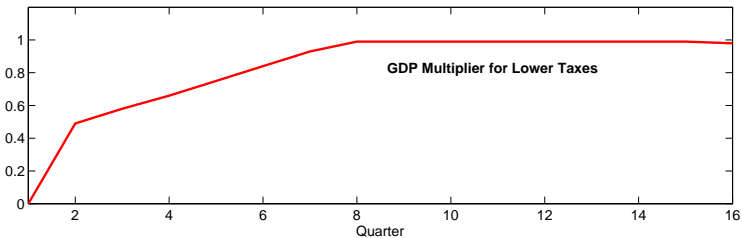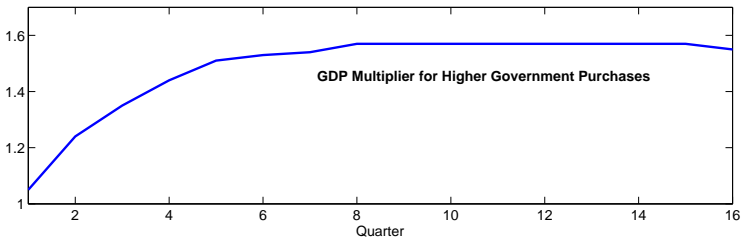
Permanent Fiscal Shocks

SOME QUESTIONS

- What economic models underlie the multipliers?
- Are the numbers reproducible?
- Why consider *permanent* changes when the Act makes transitory changes?
- What are the consequences of the stimulus for government debt?
- What are the repercussions of significantly higher debt?
- Will the debt run-up be sustained or retired?
- At what level will debt stabilize?
- How will policies adjust in the future to either sustain or retire debt?
- What assumptions about current and future monetary policy are embedded in the multipliers?

SOME ANSWERS FROM OBAMA ADMINISTRATION

SOME ANSWERS FROM ECONOMIC RESEARCH

- Three models of fiscal policy

1. Neoclassical growth model I (Leeper-Plante-Traum)
   - fiscal detail: 3 taxes rates, G consumption, transfers
   - sources of inertia
   - estimated to U.S. data

2. Neoclassical growth model II (Leeper-Walker-Yang)
   - fiscal detail: 2 tax rates, G consumption, G investment, transfers
   - time-to-build in government infrastructure $\Rightarrow$ foresight
   - calibrated to U.S. data

3. New Keynesian model (Davig-Leeper)
   - monetary & fiscal policy
   - regime switching in policies
   - calibrated to U.S. data

NEOCLASSICAL GROWTH MODEL I

- Conventional except for specification of policy behavior
  - tax rules

$$
\begin{aligned}
\hat{\tau}_t^k &= \varphi_k \hat{Y}_t + \gamma_k \hat{B}_{t-1} + \phi_{kl} u_t^l + \phi_{kc} u_t^c + u_t^k \\
\hat{\tau}_t^l &= \varphi_l \hat{Y}_t + \gamma_l \hat{B}_{t-1} + \phi_{lk} u_t^k + \phi_{lc} u_t^c + u_t^l \\
\hat{\tau}_t^c &= \phi_{kc} u_t^k + \phi_{lc} u_t^l + u_t^c
\end{aligned}
$$

  - spending rules

$$
\begin{aligned}
\hat{G}_t &= -\varphi_g \hat{Y}_t - \gamma_g \hat{B}_{t-1} + u_t^g \\
\hat{Z}_t &= -\varphi_Z \hat{Y}_t - \gamma_Z \hat{B}_{t-1} + u_t^z
\end{aligned}
$$

  hats are log-deviations, u's are AR(1) with innovations $N(0,1)$

GROWTH MODEL I: RESULTS

- Data like to have many instruments adjust to stabilize debt

- Multipliers tend not to be very large

- Caveat: with certain monetary policies, multipliers can be *much* larger

  - short-run and long-run multipliers can be very different

- Source of financing can matter a lot, especially at longer horizons

- Both speed at which debt stabilized and size of automatic stabilizers—φ's—matter for fiscal impacts

- Takes many years to establish present-value budget balance—20 or more

FISCAL MULTIPLIERS

- A common measure [Blanchard-Perotti (2002), Romer-Bernstein (2009)]

$$\text{Impact Multiplier}(k) = \frac{\Delta Y_{t+k}}{\Delta G_t}$$

- Sweeps dynamics of fiscal variables under the rug

- Present value multiplier [Mountford and Uhlig]

$$\text{Present Value Multiplier}(k) = \frac{E_t \sum_{j=0}^{k} \prod_{i=0}^{j} (1 + r_{t+i})^{-j} \, \Delta Y_{t+k}}{E_t \sum_{j=0}^{k} \prod_{i=0}^{j} (1 + r_{t+i})^{-j} \, \Delta G_{t+k}}$$

GROWTH MODEL I: MULTIPLIERS

Capital Tax Present-Value Multipliers

Variable	1 quarter	10 quarters	∞
$\frac{\text{PV}(\Delta Y)}{\text{PV}(\Delta T^k)}$	-0.18	-0.33	-0.72
$\frac{\text{PV}(\Delta C)}{\text{PV}(\Delta T^k)}$	-0.076	-0.11	-0.47

Labor Tax Present-Value Multipliers

Variable	1 quarter	10 quarters	∞
$\frac{\text{PV}(\Delta Y)}{\text{PV}(\Delta T^l)}$	-0.19	-0.19	-0.21
$\frac{\text{PV}(\Delta C)}{\text{PV}(\Delta T^l)}$	-0.17	-0.29	-0.37

All fiscal instruments respond to debt

GROWTH MODEL I: MULTIPLIERS

Capital Tax Present-Value Multipliers

Variable	1 quarter	10 quarters	∞
$\frac{\text{PV}(\Delta Y)}{\text{PV}(\Delta T^k)}$	-0.18	-0.33	-0.72
	-0.14	-0.18	-3.70
$\frac{\text{PV}(\Delta C)}{\text{PV}(\Delta T^k)}$	-0.076	-0.11	-0.47
	-0.10	-0.18	-0.83

Labor Tax Present-Value Multipliers

Variable	1 quarter	10 quarters	∞
$\frac{\text{PV}(\Delta Y)}{\text{PV}(\Delta T^l)}$	-0.19	-0.19	-0.21
	-0.14	-0.04	0.92
$\frac{\text{PV}(\Delta C)}{\text{PV}(\Delta T^l)}$	-0.17	-0.29	-0.37
	-0.19	-0.34	0.06

Only capital and labor taxes respond to debt (red)

GROWTH MODEL I: MULTIPLIERS

Government Spending Present-Value Multipliers

Variable	1 quarter	10 quarters	∞
$\frac{\text{PV}(\Delta Y)}{\text{PV}(\Delta G)}$	0.64	0.33	0.03
$\frac{\text{PV}(\Delta C)}{\text{PV}(\Delta G)}$	-0.26	-0.35	-0.60

Transfers Present-Value Multipliers

Variable	1 quarter	10 quarters	∞
$\frac{\text{PV}(\Delta Y)}{\text{PV}(\Delta Z)}$	-0.02	-0.28	-0.59
$\frac{\text{PV}(\Delta C)}{\text{PV}(\Delta Z)}$	0.01	0.13	0.12

All fiscal instruments respond to debt

GROWTH MODEL I: MULTIPLIERS

Government Spending Present-Value Multipliers

Variable	1 quarter	10 quarters	∞
$\frac{\text{PV}(\Delta Y)}{\text{PV}(\Delta G)}$	0.64	0.33	0.03
	0.59	0.14	−0.99
$\frac{\text{PV}(\Delta C)}{\text{PV}(\Delta G)}$	−0.26	−0.35	−0.60
	−0.24	−0.27	−0.89

Transfers Present-Value Multipliers

Variable	1 quarter	10 quarters	∞
$\frac{\text{PV}(\Delta Y)}{\text{PV}(\Delta Z)}$	−0.02	−0.28	−0.59
	−0.07	−0.33	−1.40
$\frac{\text{PV}(\Delta C)}{\text{PV}(\Delta Z)}$	0.01	0.13	0.12
	0.04	0.14	−0.38

Only capital and labor taxes respond to debt (red)

G Multipliers and Fiscal Financing
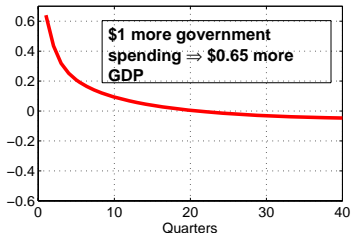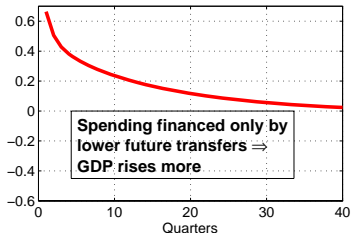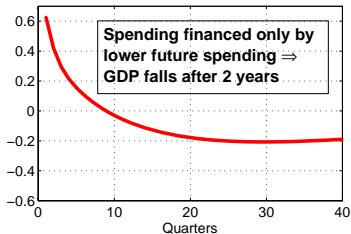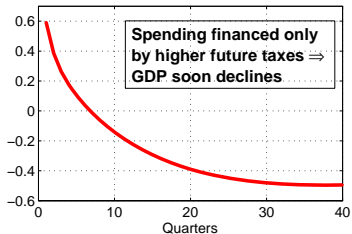
Counterfactual exercises

SPEED OF ADJUSTMENT OF FISCAL INSTRUMENTS

- Modify fiscal rules to vary responsiveness to debt
  - tax rules

$$\hat{\tau}_t^k = \varphi_k \hat{Y}_t + \mu\gamma_k \hat{B}_{t-1} + \phi_{kl} u_t^l + \phi_{kc} u_t^c + u_t^k$$
$$\hat{\tau}_t^l = \varphi_l \hat{Y}_t + \mu\gamma_l \hat{B}_{t-1} + \phi_{lk} u_t^k + \phi_{lc} u_t^c + u_t^l$$
$$\hat{\tau}_t^c = \phi_{kc} u_t^k + \phi_{lc} u_t^l + u_t^c$$

  - spending rules

$$\hat{G}_t = -\varphi_g \hat{Y}_t - \mu\gamma_g \hat{B}_{t-1} + u_t^g$$
$$\hat{Z}_t = -\varphi_Z \hat{Y}_t - \mu\gamma_Z \hat{B}_{t-1} + u_t^z$$

vary μ to speed up or slow down adjustment

DIFFERENT SPEEDS OF ADJUSTMENT
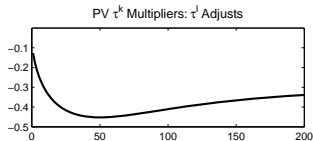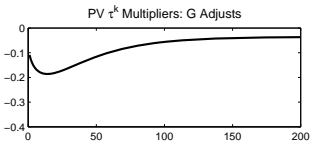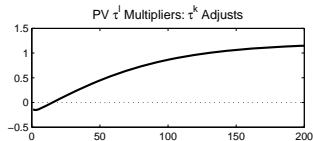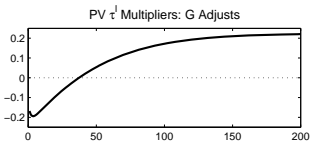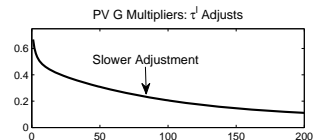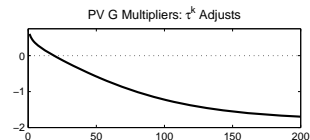
Present-value multipliers for output:
slower adjustment ($\mu = 0.5$)

DIFFERENT SPEEDS OF ADJUSTMENT
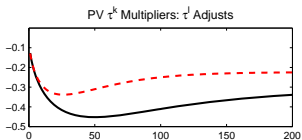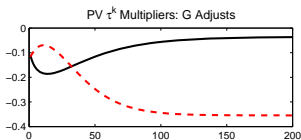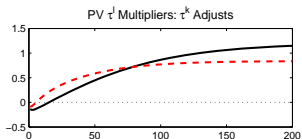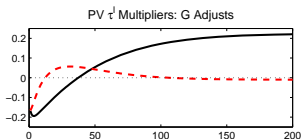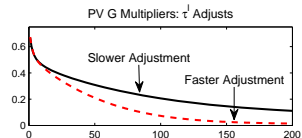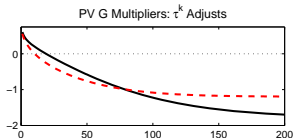
Present-value multipliers for output:
slower adjustment ($\mu = 0.5$); faster adjustment ($\mu = 2$)
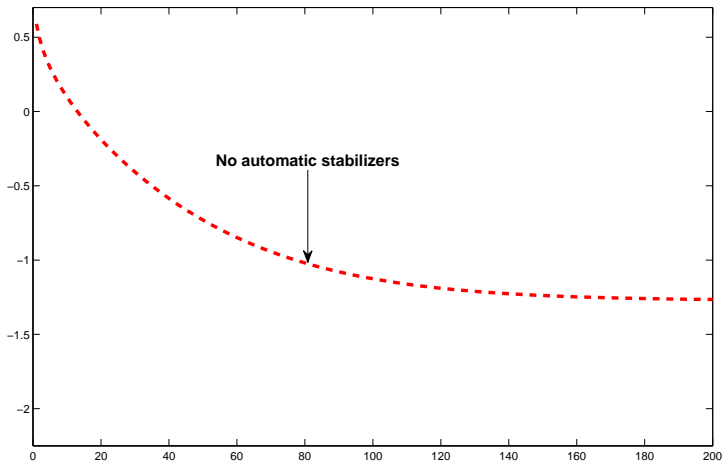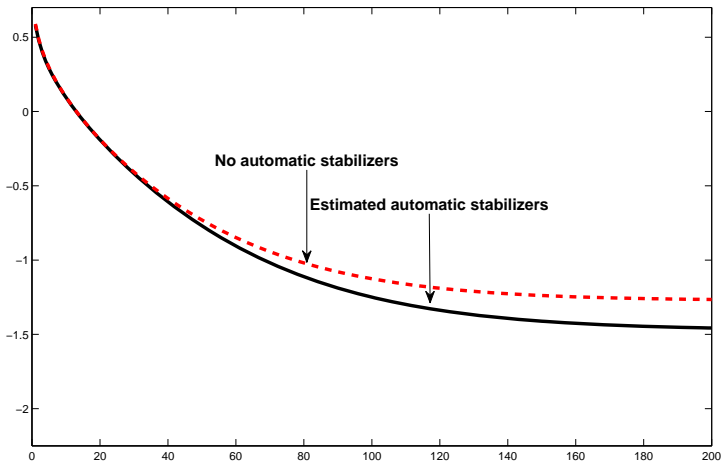
Present-value G multipliers for output: varying φ's
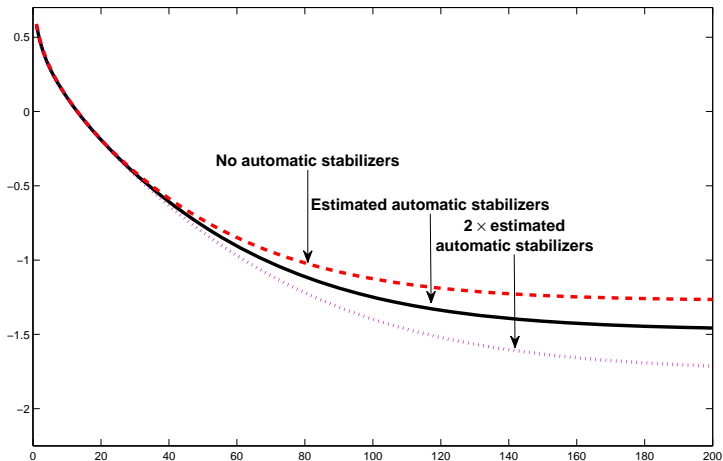
Present-value G multipliers for output: varying φ's

Present-value G multipliers for output: varying φ's
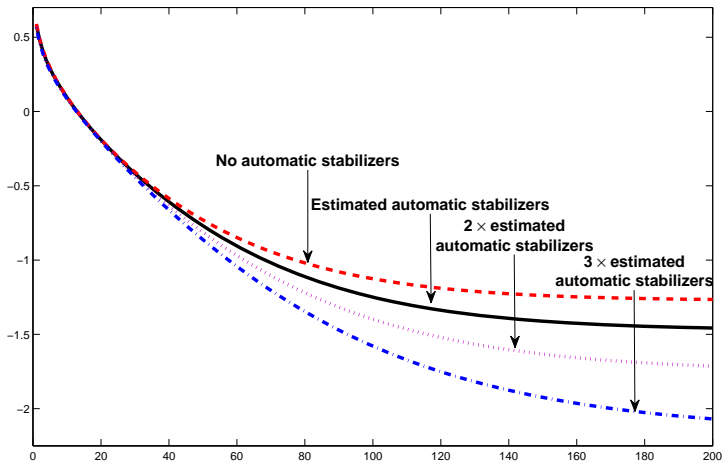
Present-value G multipliers for output: varying φ's

FISCAL FINANCING HORIZONS ARE LONG
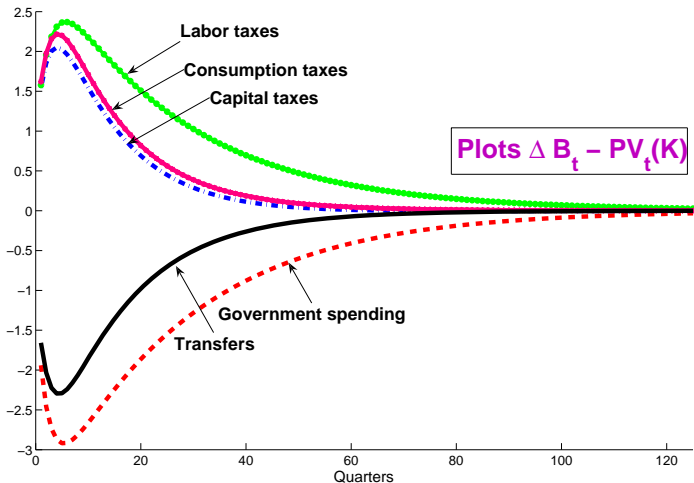
$$PV_t(K) = E_t \sum_{j=1}^{K} \beta^j [(S/B)\hat{S}_{t+j} - (1/\beta)\hat{R}_{t+j-1}]$$

NEOCLASSICAL GROWTH MODEL II

- In U.S. and Europe, heavy emphasis on government infrastructure spending
- Similar in structure to previous model; two important extensions
    - introduction of productive government investment G^I
    - introduction of time-to-build in government capital
- Distinguish between "budget authority" and "outlays"
    - "authority" occurs first, giving total spending and planned path of "outlays"
    - implementation delays modeled with time-to-build

IMPLEMENTATION DELAYS: EXAMPLE I

Estimated costs for highway construction in Title XII of the
American Recovery and Reinvestment Act of 2009

	2009	2010	2011	2012	2013	2014	2015	2016	Total
Budget Authority	27.5	0	0	0	0	0	0	0	27.5
Estimated Outlay	2.75	6.875	5.5	4.125	3.025	2.75	1.925	.55	27.5

Billions of dollars. Source: Congressional Budget Office

IMPLEMENTATION DELAYS: EXAMPLE II

Estimated costs for the National Highway Bridge
Reconstruction and Inspection Act of 2008 (not enacted)

	2009	2010	2011	2012	2013	2009-2013
Budget Authority	1,029	5	5	5	5	1,049
Estimated Outlay	280	425	169	56	46	976

Billions of dollars. Source: Congressional Budget Office

MODELING GOVERNMENT INVESTMENT

- Aggregate production

$$Y_t = A \left(u_t K_{t-1}\right)^{\alpha_K} \left(L_t\right)^{\alpha_L} \left(K_{t-1}^G\right)^{\alpha_G}$$

  - α_G critical ($\alpha_G = 0 \Rightarrow$ unproductive)
- A_t^I: budget authorization; N quarters to complete project
- Law of motion for public capital

$$K_t^G = (1 - \delta_G) K_{t-1}^G + A_{t-N+1}^I$$

  - budget authorization process an AR(1)
- Government investment implemented at t (outlaid)

$$G_t^I = \sum_{n=0}^{N-1} \phi_n A_{t-n}^I,$$

  - $\sum_{n=0}^{N-1} \phi_n = 1$; ϕ's are outlay rates

ROLE OF GOVERNMENT PRODUCTIVITY
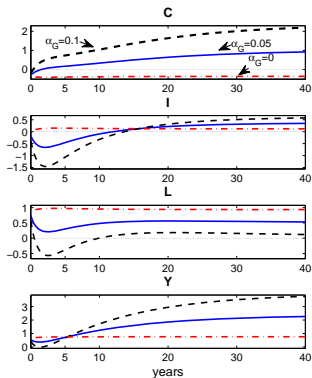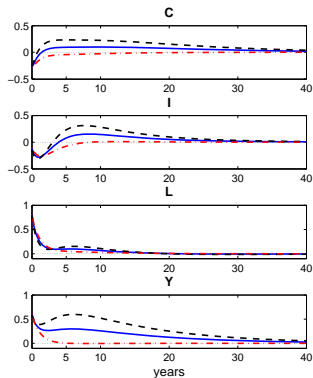
Permanent shock   Temporary shock

No implementation delays and lump-sum financing
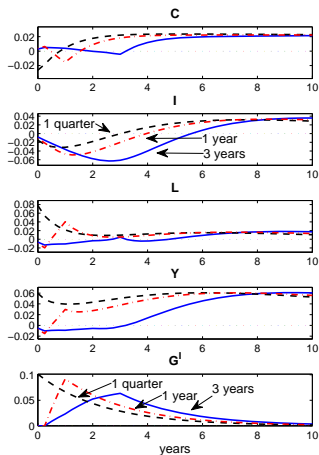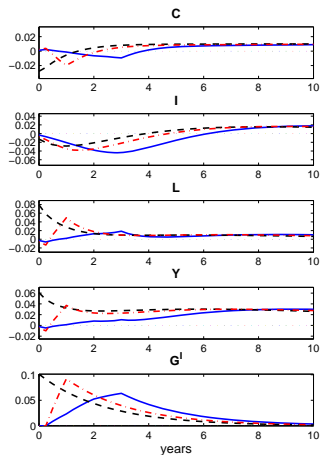
With implementation delays

DIFFERENT SPEEDS OF ADJUSTMENT
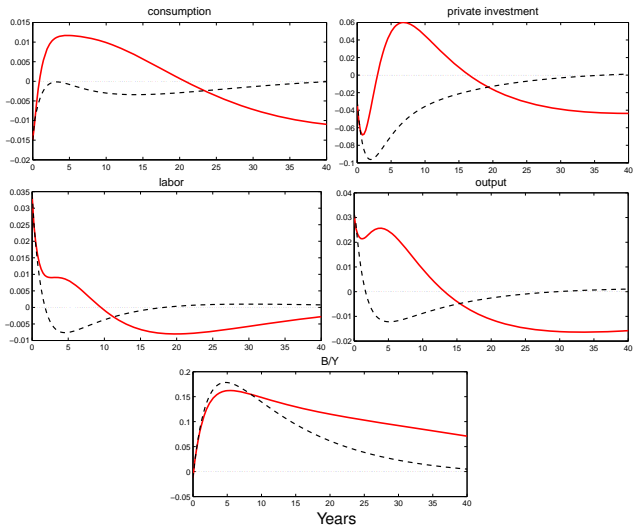
Capital taxes adjust slower (solid) and faster (dashed)

NEW KEYNESIAN MODEL

- Two key distortions that given monetary policy real effects:
  - monopolistic competition
  - sluggish price adjustment
- Elastic labor supply; inelastic capital
- Transmission mechanism of MP: real interest rates
- Transmission mechanism of FP: real interest rates & wealth effects
- Integrate monetary and fiscal policy
  - interest rate rule for MP
  - exogenous process for government spending
  - lump-sum taxes

NEW KEYNESIAN MODEL

- Estimate switching rules for monetary & tax policy
- Embed rules in calibrated model
- Four possible policy regimes:
    1. Active MP/Passive FP
    2. Passive MP/Active FP
    3. Passive MP/Passive FP
    4. Active MP/Active FP
- With fixed regime: Passive/Passive $\Rightarrow$ indeterminacy
- With fixed regime: Active/Active $\Rightarrow$ non-existence
- Can study consequences of periodically visiting those forbidden regimes
- Focus on effects of *unproductive* G

U.S. POLICY RESPONSES TO RECESSION

- Unusually aggressive **joint** policy response

    - federal funds rate near zero bound since Dec '08

    - Fed's balance sheet has more than doubled: $800 billion to $2.5 *trillion*

    - $125 billion tax refund in '08 and $787 billion stimulus package in '09

    - deficit is 13% of GDP now; debt will rise from 40% to 80% of GDP over the decade; may reach 277% by 2040

- Objective of stimulus is to create jobs by increasing consumption demand, labor demand, employment

THE MODELING EFFORT

- Model two aspects of the policy response

  1. **joint** monetary and fiscal policy effort

  2. current aggressive policies not likely to continue indefinitely

- Use standard new Keynesian model with monetary and fiscal policy regime change

- Bottom-line: government spending multipliers can be large or small, depending on policy regime

- Simulate effects of American Recovery and Reinvestment Act under alternative policy assumptions

GOVERNMENT SPENDING: CROWD OUT OR IN?

- Policy

  - Romer-Bernstein: output multiplier ≈ 1.5 and very persistent

  - CBO: stimulus makes recession less severe and shorter lived

- Research

  - no professional consensus that higher G raises private C

  - RBC or standard new Keynesian models $\Rightarrow G$ crowds out C

  - empirical evidence mixed, but favors crowding in

POLICY REGIMES

- Since the late 1940s, U.S. monetary & fiscal policies have fluctuated among:

    - Active MP $\Rightarrow$ Taylor principle holds

    - Passive MP $\Rightarrow$ Taylor principle not satisfied

    - Passive FP $\Rightarrow$ PV of taxes = PV of G

    - Active FP $\Rightarrow$ PV of taxes $<$ PV of G

- Current policy: passive MP & active FP

WHY POLICY REGIME MATTERS

- Following an increase in G...

  1. Passive MP allows the real interest rate to fall in response to higher expected inflation

  2. Active FP diminishes the negative wealth effect induced by higher taxes

- Both of these increase the stimulative effect of government spending

- These do not happen under the usual active MP/passive FP regime

- A natural & relevant way to get large G multipliers

MONETARY POLICY RULE ESTIMATES

- The monetary policy rule is

$$r_t = \alpha_0(S_t^M) + \alpha_\pi(S_t^M)\pi_t + \alpha_y(S_t^M)y_t + \sigma_r(S_t^M)\varepsilon_t^r$$

- S_t^M follows a four-state Markov chain

  - reaction coefficients and shock volatility switch independently

- Monetary policy breaks into regimes with

  - A strong response to inflation (active): $\alpha_\pi = 1.29$

  - A weak response to inflation (passive): $\alpha_\pi = .53$

FISCAL POLICY RULE ESTIMATES

- The fiscal policy rule is

$$\tau_t = \gamma_0(S_t^F) + \gamma_b(S_t^F)b_{t-1} + \gamma_y(S_t^F)y_t + \gamma_g(S_t^F)G_t + \sigma_\tau(S_t^F)\varepsilon_t^\tau$$

- S_t^F follows a two-state Markov chain

- Fiscal policy breaks into regimes with

    - Taxes rise in response to debt (passive): $\gamma_b = .07$

    - Taxes fall in response to debt (active): $\gamma_b = -.025$

U.S. MONETARY AND FISCAL REGIMES
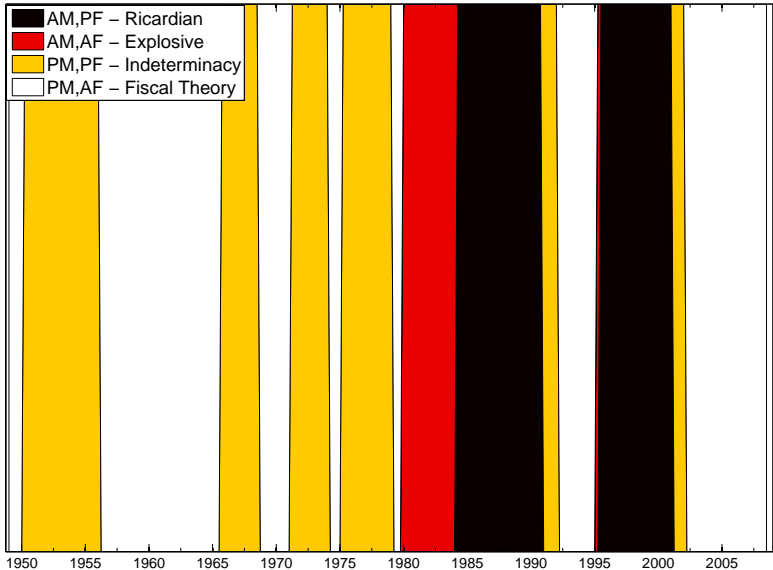
MODEL SETUP

- We use a basic New Keynesian model with variable government purchases

  - fixed capital; elastic labor supply; Calvo price rigidities

- Unproductive government spending financed via:

  - lump-sum taxes; one-period nominal bonds; seigniorage revenues

- Government purchases follow AR(1) (for now...)

- Government demands goods in same proportion as private sector

INFLATION RESPONSE CENTRAL TO G TRANSMISSION

- higher G impacts prices as follows:
    - ⇑ demand for intermediate goods
    - firms meet demand at posted prices; ⇑ labor demand
    - ⇑ real wages and real marginal costs
    - firms reoptimizing their pricing decision ⇑ prices
- Sticky prices and serially correlated G raise current and expected inflation
- Response of consumption hinges on monetary policy
    - active MP ↑ real rate; passive MP ↓ real rate, so agents pull consumption forward
    - passive fiscal policy implies higher future tax liability relative to active fiscal policy

RICARDIAN/MONETARIST WORLD

- Temporarily higher G under a fixed AM/PF policy

  1. intra-temporal substitution: demand for labor increases, hours worked and wages rise

  2. higher wages raise marginal cost and induce firms to raise prices

  3. active monetary policy raises the real rate in response to higher inflation

  4. inter-temporal substitution: agents postpone consumption due to higher real rate

  5. higher expected taxes reduce life-time wealth: agents mark down consumption path

- An increase in G lowers C with fixed AM/PF policy

NON-RICARDIAN/FISCAL WORLD

- Temporarily higher G under a fixed PM/AF policy

  1. intra-temporal substitution: demand for labor increases, hours worked and wages rise

  2. higher wages raise marginal cost and induce firms to raise prices

  3. passive monetary policy allows the real rate to decline in response to higher inflation

  4. inter-temporal substitution: agents pull consumption forward due to lower real rate

  5. PV of taxes $<$ PV of G, mitigates negative wealth effect

- An increase in G raises C with fixed PM/AF policy [Kim]

PERSPECTIVE ON TRANSMISSION OF G

- The ubiquitous **Intertemporal Equilibrium Condition** holds in all regimes

$$\frac{M_{t-1} + (1 + r_{t-1})B_{t-1}}{P_t} = E_t \sum_{T=t}^{\infty} \left[q_{t,T} \left(\tau_T - G_T + \frac{r_T}{1 + r_T} \frac{M_T}{P_T} \right) \right]$$

- A government liabilities valuation equation

- Higher path for G *without an equivalent higher path for τ* lowers the present value of primary surpluses

  - creates an imbalance—at initial prices—between the value of debt and its expected backing

- Equilibrium restored via a higher path of P, which is consistent with firms raising prices

HIGHER G: ACTIVE MP / PASSIVE FP
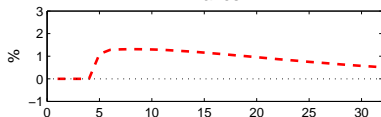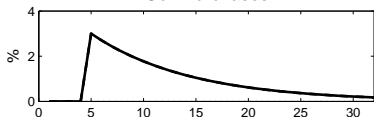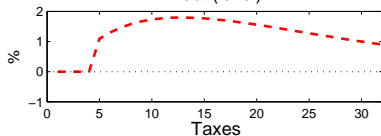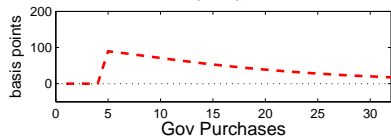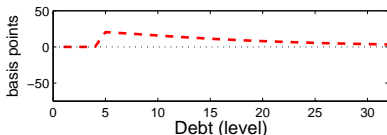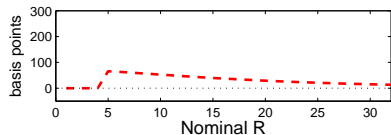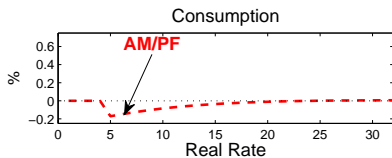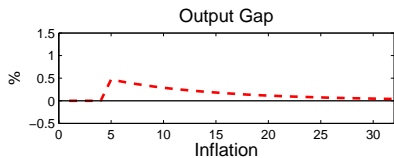
HIGHER G: PASSIVE MP / ACTIVE FP

INTERTEMPORAL ADJUSTMENTS

INTERTEMPORAL ADJUSTMENTS
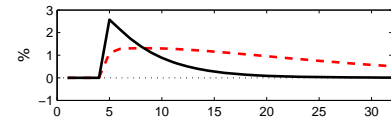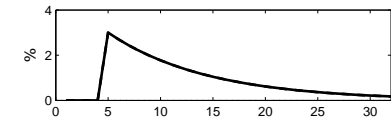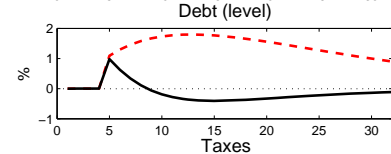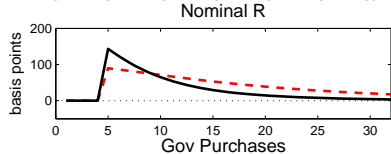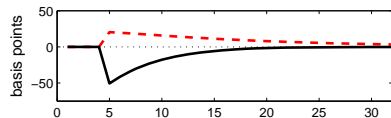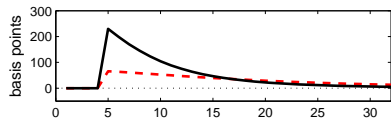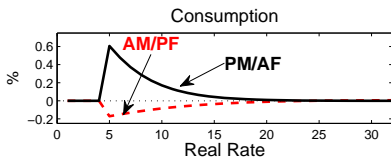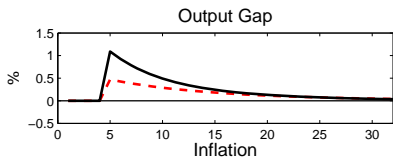
INTERTEMPORAL ADJUSTMENTS

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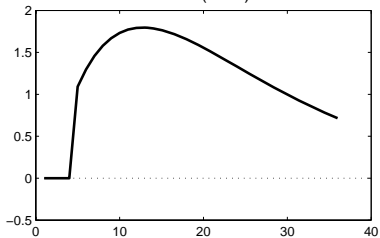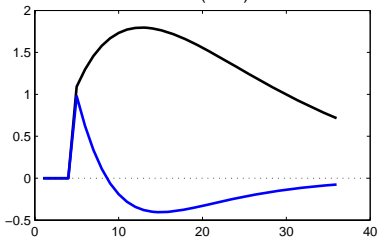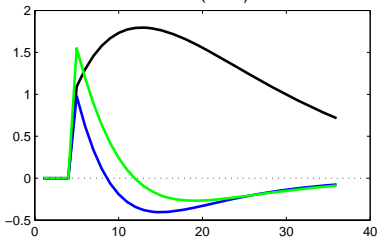
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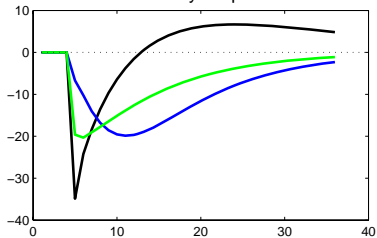
PV Primary Surplus
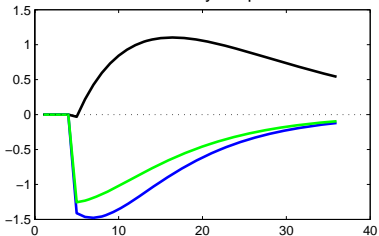
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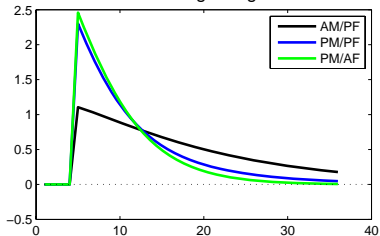
AM/PF
PM/PF
PM/AF

PRESENT VALUE MULTIPLIERS

	$\frac{PV(\Delta Y)}{PV(\Delta G)}$ after			
Regime	5 quarters	10 quarters	25 quarters	∞
AM/PF	0.79	0.80	0.84	0.86
PM/PF	1.64	1.51	1.39	1.37
PM/AF	1.72	1.58	1.40	1.36

TABLE 1: Note: $\frac{PV(\Delta C)}{PV(\Delta G)} = \frac{PV(\Delta Y)}{PV(\Delta G)} - 1$

- Values greater than unity imply a positive consumption response to increases in G

IMPACT ON THE PRICE LEVEL

	$\%\Delta P$ after		
Regime	5 quarters	10 quarters	25 quarters
AM/PF	.76	1.34	2.37
PM/PF	2.19	3.18	3.98
PM/AF	2.41	3.40	3.95

SIMULATING STIMULUS: THE 2009 ARRA

- The 2009 ARRA includes around $350 billion in spending on infrastructure, energy, healthcare, etc.

- $144 billion in federal transfers to state and local governments

    - Following Romer and Bernstein assume 60 percent is devoted to new spending

- We use the same path for additional G as Cogan, Cwik, Taylor, Wieland

- Simulate under different monetary-fiscal combinations

THE ARRA'S PATH FOR G


The Fiscal Stimulus: Path of Government Spending
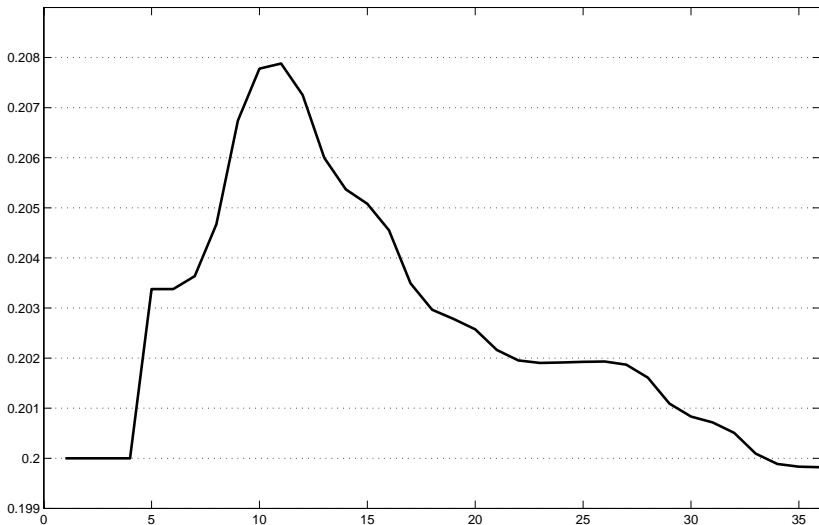
2009 ARRA: AM/PF
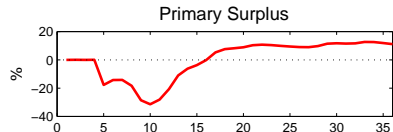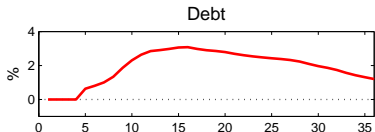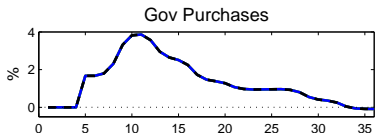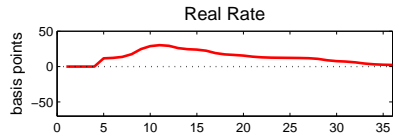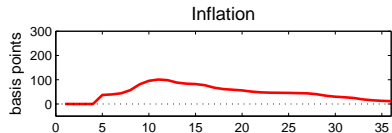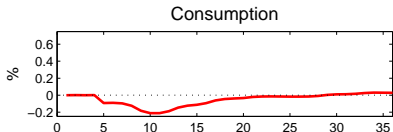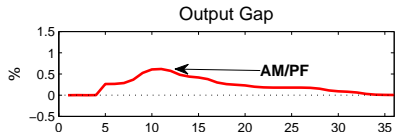
2009 ARRA: AM/PF & PM/AF
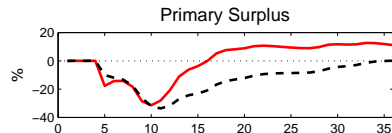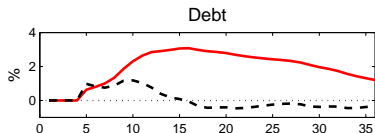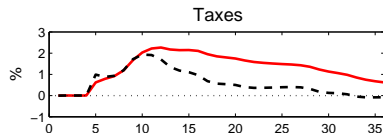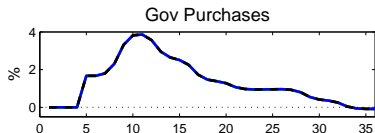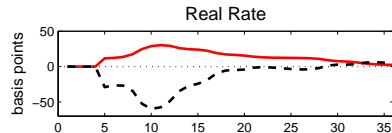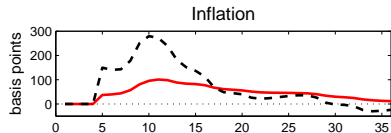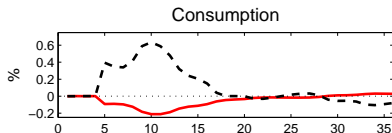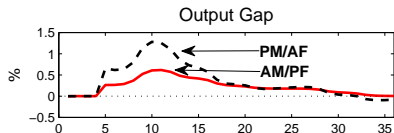
A RISKY GAME OF CHICKEN

- What if, as inflation begins to rise, the Fed switches to an active stance (from PM/AF)?

- This is a very real possibility when there is no coordination between MP & FP

- Then there are two unstable relationships:
  - inflation due to the active MP
  - debt due to the active FP

- In a fixed AM/AF regime, there would be no equilibrium

- With switching, so long as you are sufficiently far from the "fiscal limit," there is a build up of debt

- And persistently higher inflation because MP has lost control of inflation
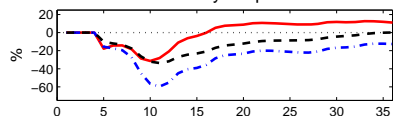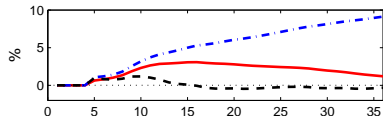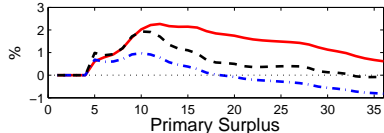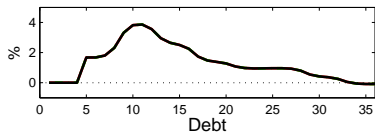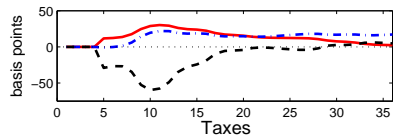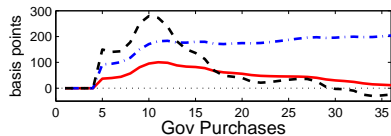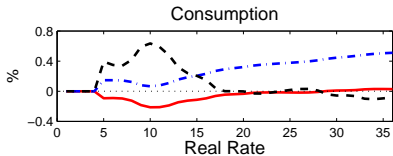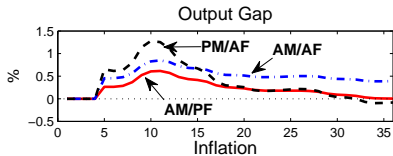
WRAP UP

- Will fiscal stimulus stimulate?
- Devil is in the details:
  - what kind of G increases?
  - what kind of T decreases?
  - are there implementation delays?
  - how do agents expect debt will be financed?
  - will debt be retired back to initial level?
  - how quickly will policy adjust to stabilize debt?
  - how will monetary policy behave?
  - how do agents expect monetary policy to behave in future?
- Policy institutions, as now structured, do not deliver clear answers to these questions
- Until they do, fiscal effects will be difficult to predict