Regime Switching in Fiscal Policy Composition

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Describe fiscal policy dynamics

- Income tax rate
- Net transfer payments
- Government expenditures
- Deficits

Describe debt service

1. How do these fiscal policy variables respond to *debt / GDP*?
2. What is the implied target for *debt / GDP*?
3. Is there switching in his behavior?

Describe stabilizing behavior

1. How do fiscal policy variables respond to *output gap*?
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Fiscal dynamics matter

Debt target and tax response matter

Given *smaller debt/GDP target* and/or *larger response of tax rate*,

- People expect higher income taxes $\rightarrow$ decreases consumption, investment, real GDP.
- Similar to Richter and Throckmorton (EER, 2015)

Fiscal composition matters

Leeper, Plante, and Traum (JoE, 2010)

- Rich set of fiscal variables responding to debt fits data best
- Magnitude of fiscal shocks depend on composition
- Fiscal multipliers can have unexpected signs, depending on composition

Debt target and interactions matter

- Fiscal responses will depend on *debt target*

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Related fiscal policy literature

- Favero and Montecelli (2005): Deficit feedback rule with *Markov switching*
  - Switching explains data better
  - Deficits switch between *active* and *passive* regimes
- Chung, Davig, Leeper (2007): Switching in monetary & fiscal policy
  - *Switching* in fiscal policy can adversely affect stabilizing impact of monetary policy
- Ko and Morita (2013): Switching in government expenditures and taxes in Japan
- Bohn (1998, 2005): Deficit responds (as it should) to debt/GDP.
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Evolution of fiscal variables

$$f_t = \rho_f(s_t) f_{t-1} + [1 - \rho_f(s_t)] f_t^*,$$

$$f_t^* = \bar{f}(s_t) + \psi_f(s_t) x_t + \gamma_f(s_t) \left[b_{t-1} - \bar{b}(s_t) \right] + u_{f,t},$$

$s_t \in \{1, 2, ..M\}$ is fiscal *regime*... more later...

Fiscal variables

$$f_t \in \{\tau_t, n_t, g_t\}$$

(1) *Tax rate*, (2) *Net transfers / GDP*, (3) *Gov exp / GDP*

Notation

f_t	Fiscal variable	x_t	Output gap
f_t^*	Time t target for f_t	$\rho_f(s_t)$	Persistence of f_t
$\bar{f}(s_t)$	*Long-run* target for f_t	$\psi_f(s_t)$	Feedback on output gap
b_t	Debt / GDP ratio	$\gamma_f(s_t)$	Feedback on debt/GDP
$\bar{b}(s_t)$	*Long-run* target for debt/GDP	$u_{f,t}$	Innovations to f_t

Evolution of stochastic shocks

$$u_{f,t} = \phi_{f,\tau}(s_t)e_{\tau,t} + \phi_{f,n}(s_t)e_{n,t} + \phi_{f,g}(s_t)e_{g,t}$$

$$e_{f,t} = \alpha_f(s_t)e_{f,t-1} + \sigma_f(s_t)v_{f,t}, \quad v_{f,t} \sim N(0,1)$$

Notation

- $\phi_{f,f'}(s_t)$: captures co-dependence of fiscal policy shocks
- $\phi_{f,f}(s_t) \equiv 1$
- $v_{f,t}$: iid shock to fiscal variable f_t
- $\sigma_f(s_t)$: standard deviation of iid shock to fiscal variable f_t

Evolution of primary deficit

$$d_t = \rho_d(s_t) d_{t-1} + [1 - \rho(s_t)]\, d_t^*$$

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Evolution of debt

Nominal terms: $B_t = (1 + r_t) B_{t-1} + D_t - (M_t - M_{t-1})$

As % of GDP: $b_t = \frac{1+r_t}{1+y_t} b_{t-1} + d_t - m_t$

- y_t: *Quarterly* nominal GDP growth
- r_t: Government borrowing rate
- $m_t \equiv (M_t - M_{t-1})/Y_t$: Seigniorage / GDP

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Four long-run fiscal targets to estimate:

- $\bar{\tau}(s_t)$: Income tax rate
- $\bar{n}(s_t)$: Net transfers / GDP
- $\bar{g}(s_t)$: Government expenditures / GDP
- $\bar{b}(s_t)$: Debt / GDP

Implied long-run deficit target

For a given regime, set $b_t = b_{t-1} = \bar{b}(s_t)$, then

$$\bar{d}(s_t) = \frac{\bar{y} - \bar{r}}{1 + \bar{y}} \bar{b}(s_t) + \bar{m},$$

Calibrate $\bar{y} = 0.0158$, avg *quarterly* growth rate in nominal GDP;
$\bar{m} = 0.0090$, avg seigniorage (*quarterly* Δ) / GDP ratio;
$\bar{r} = 0.01857$, avg of *quarterly* interest payments / debt.

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Description

- Two fiscal policy regimes, $s_t \in \{1, 2\}$
- All parameters may take on two values, one for each regime
- Each fiscal policy variable can change its,
  - long-run magnitude
  - use for stabilization (response to x_t)
  - use for balancing long-run government budget (response to b_t)
  - volatility

Exogenous Markov switching

$$P(s_t = j | s_{t-1} = i) = p_{i,j}, \quad p_{i,j} \in (0, 1) \quad \sum_{j=1}^{M} p_{i,j} = 1$$

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Federal personal income tax rate (τ_t)

$$\tau_t = \frac{IT_t}{W_t + PRI_t + RI_t + CP_t + II_t}$$

- IT is federal personal income tax (NIPA 3.2 Line 3),
- W is wages & salaries (NIPA 1.12 Line 3),
- PRI is proprietor's income (NIPA 1.12 Line 9),
- RI_t is rental income (NIPA 1.12 Line 12),
- CP_t is corporate income (NIPA 1.12, Line 13),
- II_t is interest income (NIPA 1.12 Line 12).

Federal net current transfers / GDP (n_t)

$$n_t = \frac{TRP_t - TRR_t}{GDP_t}$$

- TRP_t is federal current transfer payments (NIPA 3.2 Line 25)
- TRR_t is federal current transfer receipts (NIPA 3.2 Line 18)
- GDP_t is nominal GDP (NIPA 1.1.5 Line 1)

Government expenditures / Nominal GDP (g_t)

$$g_t = \frac{GC_t + GI_t}{GDP_t}$$

- GC_t is federal government consumption expenditures (NIPA 3.2 Line 24)
- GI_t is federal government gross investment expenditures (NIPA 3.2 Line 44)

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Primary deficit / GDP (d_t)

$$d_t = (-SG_t - IP_t)/GDP_t$$

- SG_t is net federal government saving (NIPA 3.2 Line 36)
- IP_t is federal interest payments (NIPA 3.2 Line 32)

Exogenous budget constraint variables

- Interest payments / GDP, $r_t = IP_t/Debt_t$, where $Debt_t$ is total federal debt.
- Seigniorage / GDP, $m_t = (M_t - M_{t-1})/GDP_t$, where M_t is M2 nominal money stock.

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Endogeneity problem:

- Automatic and (quick acting?) discretionary policy causes output to affect fiscal variables (the effect I am after)
- Endogenous feedback: Fiscal policy can have immediate effect on real GDP

Instrument for output gap

- Run ARDL(4) on own lags, four lags of all variables
- Predicted values used as proxy for *exogenously explained* output gap
- Similar to Favero and Montecelli (2005)

State equation

$$\xi_t = F(s_t)\xi_{t-1} + G(s_t)z_t + M(s_t)v_t$$

- Endogenous variables: $\xi_t = [\tau_t \ n_t \ g_t \ d_t \ b_t \ e_{\tau,t} \ e_{n,t} \ e_{g,t} \ e_{d,t}]'$
- Exogenous variables: $z_t = [1 \ x_t \ y_t \ m_t]$
- Shocks: $v_t = [v_{\tau,t} \ v_{n,t} \ v_{g,t} \ v_{d,t}]$

Observation equation

$$w_t = Hx_t$$

Matrix H picks off observed variables

Kim and Nelson procedure

- Obtain a set of parameter estimates for each regime
- Estimate timing of each regime

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My Questions

- Have there been changes in regime? How does a single regime compare to multiple regimes in terms of model fit?
- What is the timing of regime changes?
- How do regimes compare in terms of long-run debt targets?
- How do regimes compare in fiscal variables' roles for stabilization? Related to long-run debt targets?
- How do regimes compare in fiscal variables' roles for balancing long-run budget?

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Future papers

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- In the context of a DSGE, describe time-dynamics of IRF of a fiscal shock, given different regimes.
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