Clearing Up the Fiscal Multiplier Morass

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National Bank of Belgium, September 2015
The Morass

► Coenen et al. (2012)

...a robust finding across all models that fiscal policy can have sizeable output multipliers.

► Cogan et al. (2010)

...multipliers are less than one.... The impact in the first year is very small. And as the government purchases decline ... the multipliers turn negative.

► When similar models & similar data yield starkly different conclusions, we have a morass
Objective

- To clear up the morass by
  - bringing more fiscal detail into Smets-Wouter style model
  - permitting government spending to be useful
  - considering alternative monetary/fiscal regimes
    - Regime M: active monetary & passive fiscal policies
    - Regime F: passive monetary & active fiscal policies
  - introducing maturity structure for government debt

- Use Bayesian prior & posterior analysis
  - prior predictive to understand range of multipliers a model can produce before confronting data
  - select specification that a prior can produce large or small multipliers
  - take that flexible specification to data
  - adopt relatively diffuse priors to let data speak
What We Find

- Posterior estimates for U.S. data 1955q1–2014q2

1. High degrees of nominal rigidities & habit formation
2. Government spending complements private consumption
3. Impact output multipliers \( \approx 1.4 \) in both regimes
4. Long-run output multipliers: 0.7 in M; 1.9 in F (in present value)
5. Consumption multipliers positive: \( \approx 0.2 - 0.3 \) (in PV)
6. Investment multipliers: definitely negative in M; more likely positive in F
7. Fiscal financing very different across regimes
8. Transmission mechanisms very different across regimes but real interest rates rise in both regimes!
9. Data do not strongly prefer one regime over the other
Prior Predictive Analysis

- Key model features

1. Labor & capital
2. External habits over total consumption—private plus government
   - $G$ may complement or substitute for $C$
3. “Saver” and “non-saver” households
4. Monopolistic competition in goods & labor sectors
5. Price & wage rigidities; real rigidities
6. Constant maturity structure for bonds
7. Interest-rate rule for monetary policy
8. Fiscal rules for: consumption, labor & capital taxes; purchases; transfers

- Nests: RBC real frictions, new Keynesian, new Keynesian non-savers, new Keynesian $G$ in utility
Prior Predictive Technique

- Four steps

1. Given DSGE, $A_j$, parameters, $\theta_{A_j}$, posit prior $p(\theta_{A_j} | A_j)$
2. Linearize DSGEs to obtain $\{A_j\}$; generate ex ante predictive densities for observables, $y_T$, from $p(y_T | A_j) = \int_{\Theta_{A_j}} p(\theta_{A_j} | A_j)p(y_T | \theta_{A_j} A_j) d\theta_{A_j}$
3. Specify vector of interest, $\omega$, a function of $y_T$, with distribution $p(\omega_T | y_T, \theta_{A_j}, A_j)$
4. Prior predictive distribution from draws $\theta^{(m)}_{A_j} \sim p(\theta_{A_j} | A_j)$, and $y_T^{(m)} \sim p(y_T | \theta^{(m)}_{A_j}, A_j)$ to obtain $p(y_T | A_j)$ and any function of $y_T$ including the vector of interest, $\omega^{(m)}$

- We study $p(\omega_T | y_T, \theta_{A_j}, A_j)$
- Sheds light on model’s predictions before confronting data
- Is the model useful for studying multipliers?
Multiplier Definition

We compute present-value multipliers using model-generated impulse responses

Present Value Multiplier($k$) = \[ E_t \sum_{j=0}^{k} \left( \prod_{i=0}^{k} (1 + r_{t+i})^{-1} \right) \Delta Y_{t+j} \]
\[ E_t \sum_{j=0}^{k} \left( \prod_{i=0}^{k} (1 + r_{t+i})^{-1} \right) \Delta G_{t+j} \]

$r_t$: model-implied real interest rate
$G_t$: change in government spending—exogenous & endogenous

Some observations

- $k = 0$ is impact multiplier
- PV multiplier cumulative: value at $t + k$ is total effect over $k$ periods of change in spending at $t$
- consumption & investment multipliers defined analogously
Use the prior predictive analysis to answer

1. Given a model, what is \( \text{Prob}\left( PV \frac{\Delta Y}{\Delta G} > 1 \right) \)?

2. Given a model, what range of possible multipliers fall within a 90 percent probability band?

Model definition includes policy regime

Calibrate some parameters

- \( \beta, \alpha, \delta, \bar{\pi}, \frac{G}{Y}, \frac{B}{Y}, \bar{\tau}^L, \bar{\tau}^K, \bar{\tau}^C \) & markups
- for both prior predictive & estimation
Active monetary/passive fiscal policy

- Central bank aggressively targets inflation
- Fiscal authority adjusts taxes & expenditures to stabilize debt
- The conventional policy regime, though fiscal behavior is usually implicit

Passive monetary/active fiscal policy

- Fiscal authority sets taxes & expenditures independently of debt
- Central bank permits surprise inflation & bond prices to revalue & stabilize debt
- Zero lower bound a special case
- Few studies permit study of this region of the parameter space
How Likely Are Large Multipliers?

Prob\(\left( PV \frac{\Delta Y}{\Delta G} > 1 \right) \)

<table>
<thead>
<tr>
<th>Model</th>
<th>Impact</th>
<th>10 qtrs</th>
<th>10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model 1:</strong> RBC Real Frictions</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Model 2:</strong> New Keynesian Sticky Prices &amp; Wages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regime M</td>
<td>0.12</td>
<td>0.00</td>
<td>0.01</td>
</tr>
<tr>
<td>Regime F, short debt</td>
<td>1.00</td>
<td>0.94</td>
<td>0.92</td>
</tr>
<tr>
<td>Regime F, long debt</td>
<td>0.96</td>
<td>0.68</td>
<td>0.68</td>
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<tr>
<td><strong>Model 3:</strong> New Keynesian Nonsavers</td>
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<tr>
<td>Regime M</td>
<td>0.59</td>
<td>0.06</td>
<td>0.04</td>
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<tr>
<td>Regime F, short debt</td>
<td>1.00</td>
<td>0.97</td>
<td>0.94</td>
</tr>
<tr>
<td>Regime F, long debt</td>
<td>1.00</td>
<td>0.81</td>
<td>0.76</td>
</tr>
<tr>
<td><strong>Model 4:</strong> New Keynesian G-in-Utility</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regime M, substitutes</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Regime M, complements</td>
<td>0.84</td>
<td>0.49</td>
<td>0.25</td>
</tr>
<tr>
<td>Regime M, complements, ss tax only</td>
<td>0.84</td>
<td>0.54</td>
<td>0.47</td>
</tr>
<tr>
<td>Regime M, complements, no tax</td>
<td>0.86</td>
<td>0.56</td>
<td>0.52</td>
</tr>
<tr>
<td>Regime F, substitutes, short debt</td>
<td>0.43</td>
<td>0.66</td>
<td>0.81</td>
</tr>
<tr>
<td>Regime F, substitutes, long debt</td>
<td>0.23</td>
<td>0.21</td>
<td>0.45</td>
</tr>
<tr>
<td>Regime F, complements, short debt</td>
<td>1.00</td>
<td>1.00</td>
<td>0.97</td>
</tr>
<tr>
<td>Regime F, complements, long debt</td>
<td>1.00</td>
<td>0.93</td>
<td>0.88</td>
</tr>
<tr>
<td>Regime F, complements, short debt, ss tax only</td>
<td>1.00</td>
<td>0.99</td>
<td>0.97</td>
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<td>Regime F, complements, long debt, no tax</td>
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<td>0.95</td>
<td>0.92</td>
</tr>
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</table>

Note: Regime F yields more persistently large multipliers
How Big Are Output Multipliers in Regime M?

Government spending in utility unrestricted, steady-state taxes only, long debt (black lines) [mean & 90% credible set]
How Big Are Output Multipliers in Regime M?

Rule-of-thumb agents, everything responds to debt, long debt (red lines) [mean & 90% credible set]
Rule-of-thumb agents, steady-state taxes only, long debt (blue lines) [mean & 90% credible set]
How Big Are Output Multipliers in Regime F?

Government spending in utility unrestricted, steady-state taxes only, long debt (black lines) [mean & 90% credible set]
How Big Are Output Multipliers in Regime F?

Rule-of-thumb agents, everything responds to debt, long debt (red lines) [mean & 90% credible set]
Rule-of-thumb agents, steady-state taxes only, long debt (blue lines) [mean & 90% credible set]
What We Learn From the Prior Predictive

1. In M, rule-of-thumb agents deliver tighter prior distributions for multipliers
2. In M, when all instruments stabilize debt, multipliers are uniformly smaller than when only steady-state taxes exist and transfers and spending stabilize
3. In F, rule-of-thumbers still tighten distribution
4. In F, treatment of taxes irrelevant
5. $G$ in utility permits wider range & more persistence
   - Rule-of-thumbers hardwire results to a larger extent than does $G$ in utility
   - Adopt $G$ in utility and let data determine if complement or substitute
   - No good quarterly data on marginal tax rates
     - retain steady-state distorting taxes
     - only transfers and government spending stabilize debt in regime M
Estimation

- Estimate model suggested by prior predictive analysis
- Eight U.S. observables, quarterly 1955q1–2014q2
  1. Consumption (growth rate)
  2. Investment (growth rate)
  3. Federal government consumption (growth rate)
  4. Real wages (growth rate)
  5. Real market value of federal government debt (growth rate)
  6. Hours worked
  7. GDP deflator inflation
  8. Federal funds rate

- Calibrate some parameters (5-year fixed maturity)
- Also consider two subperiods
  - 1955q1–1979q4
  - 1982q1–2007q4
Priors for Estimation

- Including government consumption & debt in observables...
  - more spectral power at low frequencies
  - greater persistence in data compared to typical monetary policy models
- Some priors more diffuse than in much literature
  - data want high values for stickiness & habits
- Priors for policy parameters differ across regimes
- Completely agnostic about role of $G$ in utility
More prior probability on high rigidities
High probability of either regime M or F
Uniform prior ⇒ agnostic about role of $G$
## Posterior Estimates of Critical Parameters

### 1955q1:2014q2

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Regime M</th>
<th>Regime F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean</td>
<td>90% C.S.</td>
</tr>
<tr>
<td><strong>Preference and HHs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\theta$, habit formation</td>
<td>1.00</td>
<td>[0.99, 1.00]</td>
</tr>
<tr>
<td>$\alpha_G$, $G$ in utility</td>
<td>-0.24</td>
<td>[-0.41, -0.07]</td>
</tr>
<tr>
<td><strong>Frictions &amp; Production</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\omega_p$, price stickiness</td>
<td>0.92</td>
<td>[0.90, 0.94]</td>
</tr>
<tr>
<td>$\omega_w$, wage stickiness</td>
<td>0.92</td>
<td>[0.89, 0.94]</td>
</tr>
<tr>
<td>$\chi_p$, price indexation</td>
<td>0.06</td>
<td>[0.01, 0.11]</td>
</tr>
<tr>
<td>$\chi_w$, wage indexation</td>
<td>0.18</td>
<td>[0.11, 0.26]</td>
</tr>
<tr>
<td><strong>Monetary Policy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\phi_\pi$, interest rate resp. to inflation</td>
<td>0.90</td>
<td>[0.74, 1.06]</td>
</tr>
<tr>
<td>$\phi_y$, interest rate resp. to output</td>
<td>0.10</td>
<td>[0.08, 0.12]</td>
</tr>
<tr>
<td>$\rho_r$, lagged interest rate resp.</td>
<td>0.71</td>
<td>[0.64, 0.78]</td>
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<tr>
<td><strong>Fiscal Policy</strong></td>
<td></td>
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<tr>
<td>$\gamma_G$, govt cons. resp. to debt</td>
<td>0.26</td>
<td>[0.17, 0.35]</td>
</tr>
<tr>
<td>$\gamma_Z$, transfer resp. to debt</td>
<td>-0.11</td>
<td>[-0.20, -0.02]</td>
</tr>
<tr>
<td><strong>Shocks</strong></td>
<td></td>
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<tr>
<td>$\rho_a$, technology</td>
<td>0.23</td>
<td>[0.12, 0.35]</td>
</tr>
<tr>
<td>$\rho_b$, preference</td>
<td>0.40</td>
<td>[0.30, 0.50]</td>
</tr>
<tr>
<td>$\rho_{em}$, monetary policy</td>
<td>0.39</td>
<td>[0.26, 0.50]</td>
</tr>
<tr>
<td>$\rho_i$, investment</td>
<td>0.69</td>
<td>[0.62, 0.77]</td>
</tr>
<tr>
<td>$\rho_w$, wage markup</td>
<td>0.18</td>
<td>[0.09, 0.26]</td>
</tr>
<tr>
<td>$\rho_p$, price markup</td>
<td>0.74</td>
<td>[0.67, 0.82]</td>
</tr>
<tr>
<td>$\rho_{eg}$, govt cons</td>
<td>0.13</td>
<td>[0.06, 0.20]</td>
</tr>
<tr>
<td>$\rho_{ez}$, transfers</td>
<td>0.80</td>
<td>n.e.</td>
</tr>
</tbody>
</table>
Phillips Curves Are Flat

<table>
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<tbody>
<tr>
<td></td>
<td>mean</td>
<td>90% C.S.</td>
</tr>
<tr>
<td>Inflation Phillips curve slope</td>
<td>0.0071</td>
<td>[0.0036, 0.0104]</td>
</tr>
<tr>
<td>Wage Phillips curve slope</td>
<td>0.0005</td>
<td>[0.0002, 0.0008]</td>
</tr>
</tbody>
</table>

- Important elements in transmission mechanism of $G$
  - strong nominal rigidities & flat Phillips curves
  - strong habit formation
  - spending reversals in regime M
- Expected inflation (wages) affect current inflation (wages) via shifts in Phillips curves
Some Model Comparisons

<table>
<thead>
<tr>
<th>Regime M</th>
<th>Regime F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log Marginal Data Density</td>
<td>1955q1</td>
</tr>
<tr>
<td>1979q4</td>
<td>-1122</td>
</tr>
<tr>
<td>-2007q4</td>
<td>-2557</td>
</tr>
</tbody>
</table>

- No strong evidence in favor of one regime over other
- Weak preference for F in 1955q1–2014q2
- Weak preference for M in 1982q1–2007q4
- Will study multipliers conditional on each regime
Data Are Informative About Multipliers in M

Output Multiplier in Regime M: $PV \frac{\Delta Y}{\Delta G}$

<table>
<thead>
<tr>
<th></th>
<th>Impact</th>
<th>10 qtrs</th>
<th>10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior</td>
<td>0.80</td>
<td>0.56</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>[-0.58,2.12]</td>
<td>[-0.38,1.55]</td>
<td>[-0.41,1.53]</td>
</tr>
<tr>
<td>Posterior</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$1955q1–2014q2$</td>
<td>1.36</td>
<td>0.90</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>[1.17,1.55]</td>
<td>[0.72,1.09]</td>
<td>[0.45,0.94]</td>
</tr>
<tr>
<td>$1955q1–1979q4$</td>
<td>1.41</td>
<td>0.67</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>[1.15,1.68]</td>
<td>[0.50,0.83]</td>
<td>[0.24,0.47]</td>
</tr>
<tr>
<td>$1982q1–2007q4$</td>
<td>1.26</td>
<td>0.68</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>[1.03,1.48]</td>
<td>[0.50,0.86]</td>
<td>[0.13,0.54]</td>
</tr>
</tbody>
</table>

- Data are informative: uniformly shrinks credible sets
  - also true for $C$ and $I$ multipliers
- Likely $>1$ in short run; $<<1$ in longer run
- Bigger over full sample that includes crisis
### Data Are Informative About Multipliers in F

**Output Multiplier in F:** $PV \frac{\Delta Y}{\Delta G}$

<table>
<thead>
<tr>
<th>Period</th>
<th>Impact</th>
<th>10 qtrs</th>
<th>10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior</td>
<td>1.34</td>
<td>1.17</td>
<td>1.31</td>
</tr>
<tr>
<td></td>
<td>[-0.13,2.75]</td>
<td>[0.22,2.12]</td>
<td>[0.30,2.23]</td>
</tr>
<tr>
<td>Posterior</td>
<td>1.51</td>
<td>1.58</td>
<td>1.87</td>
</tr>
<tr>
<td>$1955q1–2014q2$</td>
<td>[1.33,1.70]</td>
<td>[1.39,1.76]</td>
<td>[1.65,2.09]</td>
</tr>
<tr>
<td>$1955q1–1979q4$</td>
<td>1.42</td>
<td>1.13</td>
<td>1.33</td>
</tr>
<tr>
<td></td>
<td>[1.15,1.69]</td>
<td>[0.91,1.34]</td>
<td>[1.13,1.53]</td>
</tr>
<tr>
<td>$1982q1–2007q4$</td>
<td>1.24</td>
<td>1.18</td>
<td>1.43</td>
</tr>
<tr>
<td></td>
<td>[1.00,1.49]</td>
<td>[0.96,1.41]</td>
<td>[1.20,1.65]</td>
</tr>
</tbody>
</table>

- Data are informative: uniformly shrinks credible sets
  - also true for $C$ and $I$ multipliers
- Compared to regime M
  - short-run slightly higher
  - long-run substantially higher
  - no tendency to decay
- Bigger over full sample
Dynamic Responses Across Regimes

Regime M
[mean & 90% credible set]
Dynamic Responses Across Regimes

Regime M & Regime F
[mean & 90% credible set]
Transmission Mechanism in Both Regimes

- Labor market
  - labor rises—more weakly in M than in F
  - real wages—flat in M; rise strongly in F
  - strong increase in demand in F; less so in M

- Complementarity of $G$ with $C$
  - produces persistently higher $C$ in both regimes
  - higher $C$ strongly crowds out $I$ in M; not in F

- Inflation & nominal interest rate rise in both
  - about twice as much in F as in M
  - long-run real interest rates rise in both regimes

- Fiscal dynamics
  - market value of debt falls initially in both regimes
  - value of debt substantially higher in M than in F
  - primary deficits become surpluses in F
Long-Run Fiscal Dynamics Across Regimes

Regime M & Regime F
Spending reversals & fiscal overshooting in regime M
Digging Deeper: Counterfactuals in Regime M

Baseline estimates (blue lines)
Lower habits, $\theta = 0.8$ and no government spending in utility, $\alpha_G = 0$ (red lines)
Digging Deeper: Counterfactuals in Regime M

Lower habits, $\theta = 0.8$ and no government spending in utility, $\alpha_G = 0$

- Complementarity of $G$ for $C$ essential for positive $C$ multipliers
More aggressive monetary policy, $\phi_\pi = 1.35$ and $\phi_y = 0.2$ (black lines)
More aggressive monetary policy, $\phi_{\pi} = 1.35$ and $\phi_y = 0.2$

- Raises real rates sharply, reducing all multipliers
  - still lower capital stock reduces longer-run $Y$ & $C$ multipliers
Digging Deeper: Counterfactuals in Regime M

Ricardian model, $\gamma_G = 0, \gamma_Z = 0.2$ (magenta lines)
Ricardian model, $\gamma_G = 0, \gamma_Z = 0.2$

- Prevalent in literature—depresses economic activity
- government spending reversals change wealth effects
- raise wages, employment, and multipliers
Digging Deeper: Counterfactuals in Regime F

Baseline estimates (blue lines)
Digging Deeper: Counterfactuals in Regime F

Lower nominal rigidities, $\omega_p = \omega_w = 0.7$ (red lines)
Lower nominal rigidities, $\omega_p = \omega_w = 0.7$

- Dramatically amplify $G$ impacts
  - triggers usual regime F effects: much lower real rates
  - large increases in wages, labor, inflation, $Y$, $C$ and $I$
Lower habits, \( \theta = 0.8 \), no government spending in utility, \( \alpha_G = 0 \), and less persistent spending shock, \( \rho_G = 0.9 \) (black lines)
Digging Deeper: Counterfactuals in Regime F

Lower habits, $\theta = 0.8$, no government spending in utility, $\alpha_G = 0$, and less persistent spending shock, $\rho_G = 0.9$

- $G$ complementarity much less important than in F
- $\alpha_G = 0$ makes short-run $C$ multiplier negative, but longer-run still positive
Lower nominal rigidities, $\omega_p = \omega_w = 0.7$, lower habits, $\theta = 0.8$, no government spending in utility, $\alpha_G = 0$, and less persistent spending shock, $\rho_G = 0.9$ (magenta lines)
Lower nominal rigidities, lower habits, no government spending in utility, and less persistent spending shock

- Regime F produces positive consumption effects even without these estimated features
Steady-State Counterfactuals in Regime F

- Special case of regime M is Ricardian equivalence
  - in estimates, it breaks down because $G$ used to stabilize debt
- There are no cases in regime F consistent with Ricardian equivalence
  - government debt important state variable
- To understand role of debt in F, intervene on steady state
  - eliminate maturity structure
  - raise steady state debt-GDP
  - reduce steady-state distorting tax rates
Digging Deeper: Counterfactuals in Regime F

Baseline estimates (blue lines)
Digging Deeper: Counterfactuals in Regime F

Only one-period debt, $\rho = 0$ (red lines)
Only one-period debt, $\rho = 0$

- Raises current inflation; all but eliminates long-run inflation & real rates
- Value of debt higher; wealth effects stronger; larger multipliers
Higher steady state debt-GDP ratio, $s^b = 150$ percent (black lines)
Higher steady state debt-GDP ratio, $s^b = 150$ percent

- Raises “nominal tax base;” smaller inflation effect
- Value of debt lower; wealth effects weaker; multipliers smaller
Steady-state tax rates reduced by 40 percent (magenta lines)
Steady-state tax rates reduced by 40 percent

- Lower expected future revenues; raises wealth
- Raises economic activity; raises tax bases; attenuates wealth effects
Define some variables

ex-post bond return: \( \hat{r}_t^B \equiv (\beta \rho / e^\gamma) \hat{P}_t^B - \hat{P}_{t-1}^B - \hat{\pi}_t \)

exogenous \( G \): \( \hat{G}_t^x \)

endogenous \( G \): \( \hat{G}_t^e \)

\( \Delta \) PV surpluses from \( G \) shock: \( \xi_t \equiv -(1 - \beta) \frac{G}{S} E_t \sum_{j=0}^{\infty} \beta^j \hat{G}^x_{t+j} \)

Intertemporal equilibrium condition (debt valuation)

\( \hat{b}_{t-1} = -\frac{\beta \rho}{e^\gamma} \hat{P}_t^B + \hat{P}_{t-1}^B + \hat{\pi}_t + (1 - \beta) E_t \sum_{j=0}^{\infty} \beta^j \hat{S}_{t+j} - E_t \sum_{j=1}^{\infty} \beta^j \hat{r}_{t+j}^B \)
Fiscal Financing Across Regimes

- Obtain sources of financing for innovation in $\xi_t$

\[
\xi_t = \hat{b}_{t-1} + \frac{\beta \rho}{e^\gamma} \hat{P}_t^B - \hat{P}_{t-1}^B - \hat{\pi}_t
\]

- surprise bond prices
- expected future real returns
- expected future endogenous surpluses

\[
+ E_t \sum_{j=1}^{\infty} \beta^j \hat{r}_{t+j}^B - (1 - \beta) E_t \sum_{j=0}^{\infty} \beta^j \hat{S}_{t+j}^e
\]

- Given posterior estimates, compute whether a component of the valuation equation

- supports financing higher $G$—positive entry
- counter financing higher $G$—negative entry
Fiscal Financing Across Regimes

<table>
<thead>
<tr>
<th>Specification</th>
<th>Posterior Estimates</th>
<th>1955q1–2014q2</th>
<th>Regime M</th>
<th>Regime F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$P_t^B$ $\hat{\pi}_t$ $PV(\hat{\pi}^B)$ $PV(\hat{Z})$ $PV(\hat{G}^e)$ $PV(\hat{S}^e)$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1955q1–2014q2</td>
<td>Posterior Estimates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regime M</td>
<td>$11.1$ $0.4$ $-6.3$ $-42.9$ $113.5$ $94.8$</td>
<td>$[8.2, 13.6]$</td>
<td>$[0.3, 0.6]$</td>
<td>$[-8.7, -3.7]$</td>
</tr>
<tr>
<td>Regime F</td>
<td>$14.4$ $0.7$ $-1.7$ $0.0$ $0.0$ $86.8$</td>
<td>$[11.8, 17.0]$</td>
<td>$[0.5, 0.8]$</td>
<td>$[-3.3, -0.2]$</td>
</tr>
</tbody>
</table>

Counterfactuals Based on 1955q1–2014q2 Estimates

<table>
<thead>
<tr>
<th>Regime M</th>
<th>$\theta = 0.8$, $\alpha_G = 0$</th>
<th>$\phi_\pi = 1.35$, $\phi_y = 0.2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ricardian</td>
<td>$3.2$ $0.0$ $-6.9$ $95.2$ $0$ $103.6$</td>
<td>$6.2$ $0.2$ $-4.2$ $-48.1$ $130.4$ $97.8$</td>
</tr>
<tr>
<td></td>
<td>$\phi_\pi = 1.35$, $\phi_y = 0.2$</td>
<td>$12.0$ $0.4$ $-10.8$ $-54.3$ $147.2$ $98.4$</td>
</tr>
</tbody>
</table>

Regime F

| Parameters | $\omega_p = \omega_w = 0.7$ | $30.9$ $4.4$ $18.5$ $0.0$ $0.0$ $46.2$ |
| Steady State | $\rho = 0$ | $0$ $0.8$ $-0.9$ $0.0$ $0.0$ $100.1$ |
| $s^b = 150\%$ | $46.0$ $2.0$ $-11.7$ $0.0$ $0.0$ $63.7$ |
| Lower $\tau$ | $20.8$ $1.0$ $0.2$ $0.0$ $0.0$ $78.0$ |

In regime F, $\hat{S}^e$ entirely endogenous labor, capital & consumption tax revenues
Wrap Up

- Paper uses prior predictive as a model specification device
  - ensures results are not hardwired
- Despite relatively diffuse priors, data highly informative
  - posterior credible sets much smaller than prior sets
  - diffuse priors land posterior in regions of parameter space that yield fresh perspectives & new transmission mechanisms
- Multipliers depend on
  - monetary/fiscal regime
  - how $G$ modeled & financed
    - in regime M: spending reversals
    - in regime F: endogenous revenues
  - degree of real & nominal rigidities
- Our results closer to Coenen et al. than to Cogan et al.
  - but our multipliers more persistent
  - transmission mechanisms very different
Clearing Up the Morass