“Unfunded Liabilities” and Uncertain Fiscal Financing

Troy Davig*, Eric M. Leeper† & Todd B. Walker†

*Federal Reserve Bank of Kansas City
† Indiana University

February 2010
Banco de España Conference
Introduction

- Profound uncertainty surrounds the funding of future promised transfers in the U.S.
“Unfunded Liabilities”

Source: CBO Long-Term Budget Outlook (June 2009)
"Unfunded Liabilities"

Source: CBO Long-Term Budget Outlook (June 2009)
“Unfunded Liabilities”

Source: CBO Long-Term Budget Outlook (June 2009)
Introduction

- Profound uncertainty surrounds the funding of future *promised* transfers in the U.S.

- **Unfunded liabilities** is not an economically meaningful term—inconsistent with equilibrium
  - The government will renege on promised transfers (i.e. “liabilities” do not exist)
  - The government will fund the promised transfers (i.e. liabilities are not “unfunded”)

- CBO projects debt rising to over 700% of GDP
Profound uncertainty surrounds the funding of future \textit{promised} transfers in the U.S.

Unfunded liabilities is not an economically meaningful term—inconsistent with equilibrium

- The government will renege on promised transfers (i.e. “liabilities” do not exist)
- The government will fund the promised transfers (i.e. liabilities are not “unfunded”)

CBO projects debt rising to over 700\% of GDP
Rolling Spending Commitments into Debt

The graph illustrates the percentage of GDP committed to spending over time, with two distinct scenarios:

- **Alternative Fiscal Scenario**
- **Extended-Baseline Scenario**

The graph is sourced from the CBO Long-Term Budget Outlook (June 2009).
Introduction

- Profound uncertainty surrounds the funding of future promised transfers in the U.S.

- Unfunded liabilities is not an economically meaningful term—inconsistent with equilibrium
  - The government will renege on promised transfers (i.e. “liabilities” do not exist)
  - The government will fund the promised transfers (i.e. liabilities are not “unfunded”)

- CBO projects debt rising to over 700% of GDP

⇒ future policy will change
Introduction

- Profound uncertainty surrounds the funding of future promised transfers in the U.S.

- **Unfunded liabilities** is not an economically meaningful term—inconsistent with equilibrium
  - The government will renege on promised transfers (i.e. “liabilities” do not exist)
  - The government will fund the promised transfers (i.e. liabilities are not “unfunded”)

- CBO projects debt rising to over 700% of GDP
  ⇒ future policy will change...how and when?
Introduction

- Nearly every advanced economy faces this problem
What We Do

- Rational expectations framework to study alternative ways to resolve “unfunded liabilities” problem
What We Do

Rational expectations framework to study alternative ways to resolve “unfunded liabilities” problem

1. Reneging on transfers
What We Do

- Rational expectations framework to study alternative ways to resolve “unfunded liabilities” problem

  1. Reneging on transfers ⇒ “Third Rail of Politics”
What We Do

- Rational expectations framework to study alternative ways to resolve “unfunded liabilities” problem
  1. Reneging on transfers ⇒ “Third Rail of Politics”
  2. Distortionary taxation
Rational expectations framework to study alternative ways to resolve “unfunded liabilities” problem

1. Reneging on transfers ⇒ “Third Rail of Politics”
2. Distortionary taxation ⇒ Fiscal limit
What We Do

- Rational expectations framework to study alternative ways to resolve “unfunded liabilities” problem
  1. Reneging on transfers \(\Rightarrow\) “Third Rail of Politics”
  2. Distortionary taxation \(\Rightarrow\) Fiscal limit
  3. Sacrificing inflation target
What We Do

Rational expectations framework to study alternative ways to resolve “unfunded liabilities” problem

1. Reneging on transfers ⇒ “Third Rail of Politics”
2. Distortionary taxation ⇒ Fiscal limit
3. Sacrificing inflation target ⇒ Volatile inflation
What We Do

- Rational expectations framework to study alternative ways to resolve “unfunded liabilities” problem
  1. Reneging on transfers ⇒ “Third Rail of Politics”
  2. Distortionary taxation ⇒ Fiscal limit
  3. Sacrificing inflation target ⇒ Volatile inflation
  4. Inflation financing (printing presses)
What We Do

- Rational expectations framework to study alternative ways to resolve “unfunded liabilities” problem
  1. Reneging on transfers ⇒ “Third Rail of Politics”
  2. Distortionary taxation ⇒ Fiscal limit
  3. Sacrificing inflation target ⇒ Volatile inflation
  4. Inflation financing (printing presses) ⇒ Fiscal limit here also
What We Do

- Rational expectations framework to study alternative ways to resolve “unfunded liabilities” problem
  1. Reneging on transfers ⇒ “Third Rail of Politics”
  2. Distortionary taxation ⇒ Fiscal limit
  3. Sacrificing inflation target ⇒ Volatile inflation
  4. Inflation financing (printing presses) ⇒ Fiscal limit here also
  5. Debt default
What We Do

Rational expectations framework to study alternative ways to resolve “unfunded liabilities” problem

1. Reneging on transfers ⇒ “Third Rail of Politics”
2. Distortionary taxation ⇒ Fiscal limit
3. Sacrificing inflation target ⇒ Volatile inflation
4. Inflation financing (printing presses) ⇒ Fiscal limit here also
5. Debt default ⇒ Are U.S. Treasuries risk-free assets?
What We Do

- Rational expectations framework to study alternative ways to resolve “unfunded liabilities” problem
  1. Reneging on transfers ⇒ “Third Rail of Politics”
  2. Distortionary taxation ⇒ Fiscal limit
  3. Sacrificing inflation target ⇒ Volatile inflation

We model a combination of 1–3, emphasizing uncertainty about which policies adjust and when policies adjust.
What We Do

- Rational expectations framework to study alternative ways to resolve “unfunded liabilities” problem
- Allow for switching among policy solutions
What We Do

- Rational expectations framework to study alternative ways to resolve “unfunded liabilities” problem
- Allow for switching among policy solutions
- Model fiscal limit as random variable $= f(\text{fiscal variables})$
What We Do

- Rational expectations framework to study alternative ways to resolve “unfunded liabilities” problem

- Allow for switching among policy solutions

- Model fiscal limit as random variable \( = f(\text{fiscal variables}) \)

- Focus on expectational effects in otherwise standard macroeconomic DSGE model
Analytic Intuition: Simple Model

- Consider a flexible price, cashless, endowment economy
Analytic Intuition: Simple Model

- Consider a flexible price, cashless, endowment economy
- The consumption Euler equation reduces to the Fisher equation

\[
\frac{1}{R_t} = \beta E_t \left( \frac{P_t}{P_{t+1}} \right)
\]

- Transfers grow at rate \( \mu \) financed by lump-sum taxes and debt

\[
z_t = (1 - \mu) z^* + \mu z_{t-1} - 1 + \varepsilon_t, \quad \mu < \frac{1}{\beta}
\]

- Government's Budget Constraint:

\[
B_t P_t + \tau_t = z_t + R_t - 1 B_{t-1} P_t
\]
Analytic Intuition: Simple Model

- Consider a flexible price, cashless, endowment economy

- The consumption Euler equation reduces to the Fisher equation

\[
\frac{1}{R_t} = \beta E_t \left( \frac{P_t}{P_{t+1}} \right)
\]

- Transfers grow at rate \( \mu \) financed by lump-sum taxes and debt

\[
z_t = (1 - \mu)z^* + \mu z_{t-1} + \varepsilon_t, \quad \mu < 1/\beta
\]
Analytic Intuition: Simple Model

- Consider a flexible price, cashless, endowment economy

- The consumption Euler equation reduces to the Fisher equation

\[
\frac{1}{R_t} = \beta E_t \left( \frac{P_t}{P_{t+1}} \right)
\]

- Transfers grow at rate \( \mu \) financed by lump-sum taxes and debt

\[
z_t = (1 - \mu)z^* + \mu z_{t-1} + \varepsilon_t, \quad \mu < 1/\beta
\]

- Government’s Budget Constraint:

\[
\frac{B_t}{P_t} + \tau_t = z_t + \frac{R_{t-1}B_{t-1}}{P_t}
\]
At time $T$ economy reaches fiscal limit
Analytic Intuition: Policy Specification

At time $T$ economy reaches fiscal limit

<table>
<thead>
<tr>
<th>Regime 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t = 0, 1, \ldots, T - 1$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monetary Policy</th>
<th>$R_t^{-1} = R^<em>^{-1} + \alpha \left( \frac{P_{t-1}}{P_t} - \frac{1}{\pi^</em>} \right)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax Policy</td>
<td>$\tau_t = \tau^* + \gamma \left( \frac{B_{t-1}}{P_{t-1}} - b^* \right)$</td>
</tr>
</tbody>
</table>
Analytic Intuition: Policy Specification

At time $T$ economy reaches fiscal limit

<table>
<thead>
<tr>
<th></th>
<th>Regime 1 $t = 0, 1, \ldots, T - 1$</th>
<th>Regime 2 $t = T, T + 1, \ldots$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Monetary Policy</strong></td>
<td>$R_t^{-1} = R^<em>-1 + \alpha \left( \frac{P_{t-1}}{P_t} - \frac{1}{\pi^</em>} \right)$</td>
<td>$R_t^{-1} = R^*-1$</td>
</tr>
<tr>
<td><strong>Tax Policy</strong></td>
<td>$\tau_t = \tau^* + \gamma \left( \frac{B_{t-1}}{P_{t-1}} - b^* \right)$</td>
<td>$\tau_t = \tau^{\text{max}}$</td>
</tr>
</tbody>
</table>
Analytic Intuition: Policy Specification

At time $T$ economy reaches fiscal limit

<table>
<thead>
<tr>
<th></th>
<th>Regime 1 $t = 0, 1, \ldots, T - 1$</th>
<th>Regime 2 $t = T, T + 1, \ldots$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monetary Policy</td>
<td>$R_t^{-1} = R^* - 1 + \alpha \left( \frac{P_{t-1}}{P_t} - \frac{1}{\pi^*} \right)$</td>
<td>$R_t^{-1} = R^* - 1$</td>
</tr>
<tr>
<td>Tax Policy</td>
<td>$\tau_t = \tau^* + \gamma \left( \frac{B_{t-1}}{P_{t-1}} - b^* \right)$</td>
<td>$\tau_t = \tau^{\text{max}}$</td>
</tr>
</tbody>
</table>

Fiscal limit may be *economic* (peak of Laffer curve) or *political* (intolerance of taxation)
If Regime 1 were absorbing state (No Fiscal Limit)
Analytic Intuition: Polar Case 1

If Regime 1 were absorbing state (No Fiscal Limit)

\[
\frac{\alpha}{\beta} E_t \left( \frac{P_t}{P_{t+1}} - \frac{1}{\pi^*} \right) = \frac{P_{t-1}}{P_t} - \frac{1}{\pi^*} \quad \text{(Regime 1)}
\]
Analytic Intuition: Polar Case 1

If Regime 1 were absorbing state (No Fiscal Limit)

\[ \frac{\alpha}{\beta} E_t \left( \frac{P_t}{P_{t+1}} - \frac{1}{\pi^*} \right) = \frac{P_{t-1}}{P_t} - \frac{1}{\pi^*} \]  

(Regime 1)

\[ E_{t-1} \left( \frac{B_t}{P_t} - b^* \right) = E_{t-1}(z_t - z^*) + (\beta^{-1} - \gamma) \left( \frac{B_{t-1}}{P_{t-1}} - b^* \right) \]
If Regime 1 were absorbing state (No Fiscal Limit)

$$\frac{\alpha}{\beta} E_t \left( \frac{P_t}{P_{t+1}} - \frac{1}{\pi^*} \right) = \frac{P_{t-1}}{P_t} - \frac{1}{\pi^*}$$  \hspace{1cm} (Regime 1)

$$E_{t-1} \left( \frac{B_t}{P_t} - b^* \right) = E_{t-1}(z_t - z^*) + (\beta^{-1} - \gamma) \left( \frac{B_{t-1}}{P_{t-1}} - b^* \right)$$

$$\alpha/\beta > 1, \beta^{-1} - \gamma < 1 \Rightarrow \text{Equilibrium } \pi_t = \pi^*$$

A Standard Monetary Equilibrium
If Regime 2 were absorbing state
If Regime 2 were absorbing state

\[ E_t \left( \frac{P_t}{P_{t+1}} \right) = \frac{1}{\beta R^*} = \frac{1}{\pi^*} \]  

(Regime 2)
Analytic Intuition: Polar Case 2

If Regime 2 were absorbing state

\[
E_t \left( \frac{P_t}{P_{t+1}} \right) = \frac{1}{\beta R^*} = \frac{1}{\pi^*} \tag{Regime 2}
\]

\[
\frac{B_t}{P_t} = \left( \frac{\beta}{1 - \beta} \right) \tau^* - E_t \sum_{j=1}^{\infty} \beta^j z_{t+j}
\]
Analytic Intuition: Polar Case 2

If Regime 2 were absorbing state

\[
E_t \left( \frac{P_t}{P_{t+1}} \right) = \frac{1}{\beta R^*} = \frac{1}{\pi^*} \quad \text{(Regime 2)}
\]

\[
\frac{B_t}{P_t} = \left( \frac{\beta}{1 - \beta} \right) \tau^* - E_t \sum_{j=1}^{\infty} \beta^j z_{t+j}
\]

\[ \alpha = 0, \, \gamma = 0 \Rightarrow \text{Actual Inflation} \]

\[
P_t = \frac{R_{t-1} B_{t-1}}{\left( \frac{1}{1-\beta} \right) \tau^* - E_t \sum_{j=0}^{\infty} \beta^j z_{t+j}}
\]

A Standard Fiscal Equilibrium
# Fiscal Limit: Reneging

<table>
<thead>
<tr>
<th>Policy Type</th>
<th>Equation</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monetary Policy</td>
<td>( R_t^{-1} = R^<em>-1 + \alpha \left( \frac{P_{t-1}}{P_t} - \frac{1}{\pi^</em>} \right) )</td>
<td>( t = 0, 1, \ldots, T-1 ) and same ( t = T, T+1, \ldots )</td>
</tr>
<tr>
<td>Tax Policy</td>
<td>( \tau_t = \tau^* + \gamma \left( \frac{B_{t-1}}{P_{t-1}} - b^* \right) )</td>
<td>( \tau_t = \tau^{\text{max}} )</td>
</tr>
<tr>
<td>Transfer Policy</td>
<td>( z_t )</td>
<td>( \lambda_t z_t )</td>
</tr>
</tbody>
</table>

\[
E_{t-1} \left[ \frac{B_t}{P_t} \right] + \tau^{\text{max}} = E_{t-1} \lambda_t z_t + (\beta^{-1} - \gamma) \left( \frac{B_{t-1}}{P_{t-1}} \right)
\]

\[
\pi_t = \pi^*
\]

## A Standard Monetary Equilibrium
Fiscal Limit: No Reneging

<table>
<thead>
<tr>
<th>Policy</th>
<th>$t = 0, 1, \ldots, T - 1$</th>
<th>$t = T, T + 1, \ldots$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monetary Policy</td>
<td>$R_t^{-1} = R_{-1}^{**} + \alpha \left( \frac{P_{t-1}}{P_t} - \frac{1}{\pi^*} \right)$</td>
<td>$R_t^{-1} = R_{-1}^{**}$</td>
</tr>
<tr>
<td>Tax Policy</td>
<td>$\tau_t = \tau^* + \gamma \left( \frac{B_{t-1}}{P_{t-1}} - b^* \right)$</td>
<td>$\tau_t = \tau_{\text{max}}$</td>
</tr>
<tr>
<td>Transfer Policy</td>
<td>$z_t$</td>
<td>same</td>
</tr>
</tbody>
</table>

\[
E_t \left( \frac{P_t}{P_{t+1}} - \frac{1}{\pi^*} \right) = \frac{\alpha}{\beta} \left( \frac{P_{t-1}}{P_t} - \frac{1}{\pi^*} \right), \quad \frac{\alpha}{\beta} > 1
\]

\[
P_t = f(z_t, \gamma, \mu, \beta, \pi^*)
\]

A New Fiscal Equilibrium Before the Limit
Analytic Intuition: Debt

Debt−GDP Target

Fiscal Limit

T = 50

Debt in Regime 2

Debt−GDP Target
Analytic Intuition: Debt

Debt in Regime 2

Debt–GDP Target

Fiscal Limit

T = 50

Debt When Fiscal Limit at T

Fiscal Limit T = 50

Debt in Regime 2
Analytic Intuition: Inflation

Inflation When Fiscal Limit at T = 50
Inflation in Regime 2
Inflation Target
Fiscal Limit T = 50
Analytic Intuition: Expected Inflation
Fiscal Limit: Implications

- Expectations of post-limit policies determine *pre-limit* equilibrium
- Inflation and debt *not* anchored on targets
- Expectations—and equilibrium—time varying as approach limit
- Pre-limit equilibrium converges to post-limit equilibrium
Promised Transfers in a DSGE Model

Other Federal Non-interest Spending
Medicare and Medicaid
Social Security

Percentage of GDP

- Other Federal Non-interest Spending
- Medicare and Medicaid
- Social Security
- Revenues
- Model
Full-Blown Model

- Standard DSGE model: capital accumulation, sticky prices, distorting taxation
- Government announces path of *promised* transfers
- Government debt and taxes grow until the economy hits *fiscal limit*
- Specify a set of policies that stabilize debt after fiscal limit
- Multiple layers of policy uncertainty
Households and Firms

- Household utility depends on consumption, leisure and real balances

- Household’s budget constraint is

\[ C_t + K_t + \frac{B_t}{P_t} + \frac{M_t}{P_t} \leq (1 - \tau_t) \left( \frac{W_t}{P_t} N_t + R^k_t K_{t-1} \right) \]

\[ + (1 - \delta) K_{t-1} + \frac{R_{t-1} B_{t-1}}{P_t} + \frac{M_{t-1}}{P_t} + \lambda_t z_t + \frac{D_t}{P_t} \]

- Firms set prices as a markup over marginal costs (Rotemberg costly adjustment)
Initial Period: Stationary Transfers

**MP:** \( R_t = R^* + \alpha(\pi_t - \pi^*), \quad \alpha > 1/\beta \)

**FP:** \( \tau_t = \tau^* + \gamma\left(b_{t-1}/Y_{t-1} - b^*\right), \quad \gamma > r \)

**Transfers:** \( z_t = (1 - \rho_z)z^* + \rho_zz_{t-1} + \varepsilon_t \)
Non-Stationary *Promised* Transfers

MP: $R_t = R^* + \alpha(\pi_t - \pi^*), \quad \alpha > 1/\beta$

FP: $\tau_t = \tau^* + \gamma(b_{t-1}/Y_{t-1} - b^*), \quad \gamma > r$

Transfers: $z_t = \mu z_{t-1} + \varepsilon_t, \quad \mu > 1$
**Fiscal Limit**

**FP:** $\tau_t = \tau^{\text{max}}$

$$P_{L,t} = \frac{\exp(\eta_0 + \eta_1 (\tau_{t-1} - \tau^*))}{1 + \exp(\eta_0 + \eta_1 (\tau_{t-1} - \tau^*))}$$
Fiscal Limit: Regime 1 AM/AF/PT

**MP:** $R_t = R^* + \alpha(\pi_t - \pi^*)$, $\alpha > 1/\beta$

**FP:** $\tau_t = \tau^{max}$

**Transfers:** $\lambda_t z_t = \lambda_t \mu z_{t-1} + \lambda_t \varepsilon_t$

$q = 0.5$

Regime 1
Fiscal Limit: Regime 2 PM/AF/AT

MP: $R_t = R^*$

FP: $\tau_t = \tau^{max}$

Transfers: $z_t = \mu z_{t-1} + \varepsilon_t$

Regime 2

1 - $q = 0.5$

Regime 1
Fiscal Limit: Switch Between Regimes

**MP:** \( R_t = \begin{cases} \frac{R^*}{\alpha}, & \alpha > \frac{1}{\beta} \\ R^*, & \alpha \leq \frac{1}{\beta} \end{cases} \)

**FP:** \( \tau_t = \tau^{max} \)

**Transfers:** \( z_t = \begin{cases} \lambda_t \mu z_{t-1} + \lambda_t \varepsilon_t, & \mu z_{t-1} + \varepsilon_t \end{cases} \)

Diagram:
- Regime 1
- Regime 2
- Transition probabilities:
  - \( 1 - p_{11} \)
  - \( 1 - p_{22} \)
Counterfactual Experiments

- Layers of uncertainty call for a probabilistic description of outcomes

- Report equilibrium transition paths conditional on *particular* realizations of policies
  - decision rules based on true probability distributions
  - agents always place probability on alternative future regimes
  - these are counterfactual exercises that induce policy regime *surprises* every period
Pre-Limit as Transfers Grow

- Dominate forces are rising debt and taxes
- Rising tax rates discourage labor effort and reduce consumption
- Inflection point in dynamics arises at limit, $\tau_{max}$
- Capital falls when $\tau_t < \tau_{max}$, then rises when $\tau_t > \tau_{max}$, in expectation of a future reduction in tax rates
Pre-Limit as Transfers Grow

Conditional on *not* triggering fiscal limit
Post-Limit Reneging ($\lambda_t < 1$)

- Monetary policy is active, but can’t stabilize inflation
- Agents believe can return to regime without reneging, but with passive monetary policy

![Graph showing Inflation and Expectations](image-url)

![Graph showing Ex-ante Real Rate](image-url)
Post-Limit Reneging ($\lambda_t < 1$)

- Low real rates reduce savings
- Capital stock declines

![Graph showing capital stock and ex-ante real rate over time](image-url)
Monetary policy is passive and $\lambda_t = 1$

Agents still believe can move to reneging regime
Post-Limit Passive Monetary Policy

- Possibility of reneging in future increases savings and postpones consumption
- Drives capital accumulation
Conclusions

- Profound uncertainty surrounds the future financing of promised transfers
- Fiscal pressures will likely impair efforts to achieve any inflation objective
  - Expected inflation will rise faster than inflation if households believe the economy may hit the fiscal limit
- In the presence of a fiscal limit, effects of the limit kick in even during “normal” times
- Underscores that to understand an intrinsically “fiscal issue,” must integrate monetary policy