EABCN Training School: Monetary-Fiscal Policy Interactions

Lecture 8. Fiscal Limits & Fiscal Stress

Eric M. Leeper

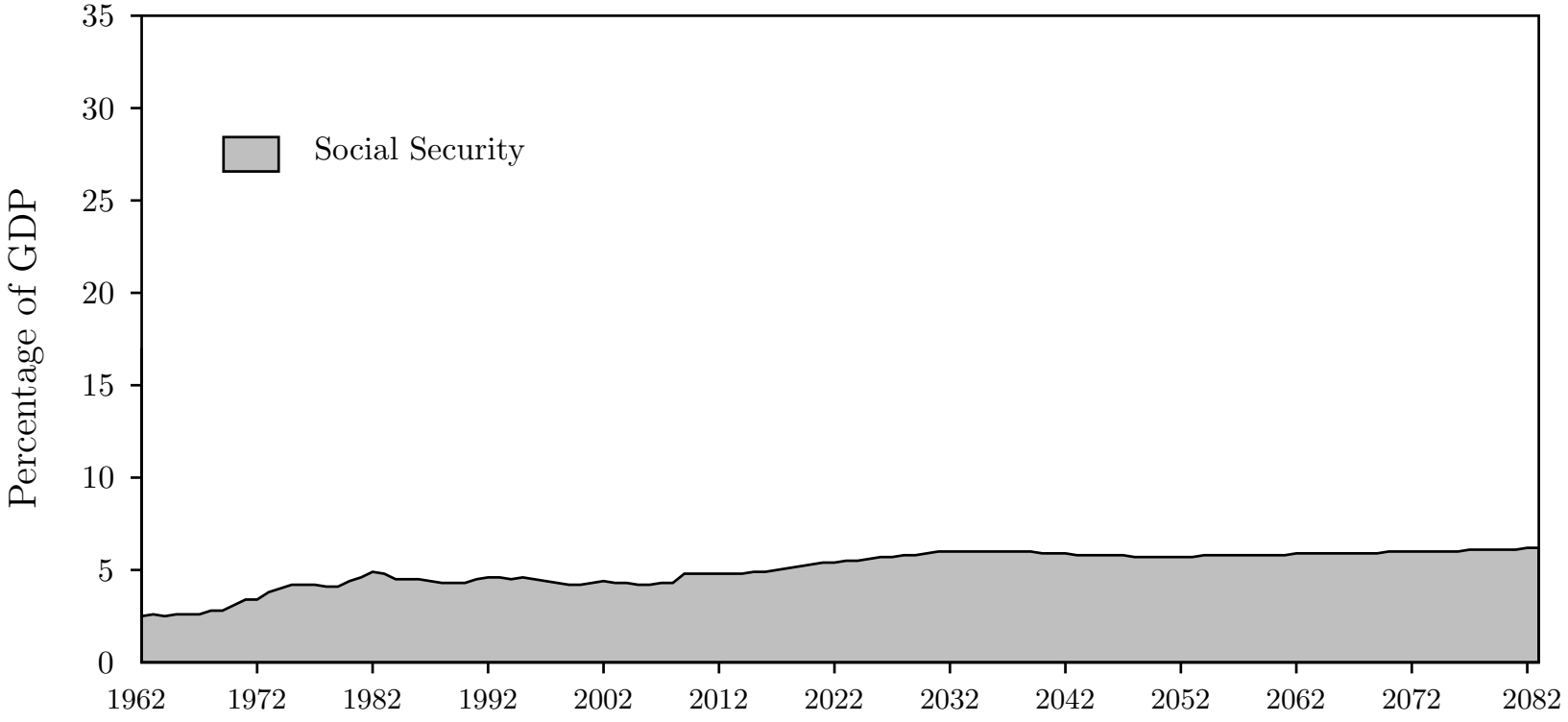
Indiana University

September 2010

INTRODUCTION

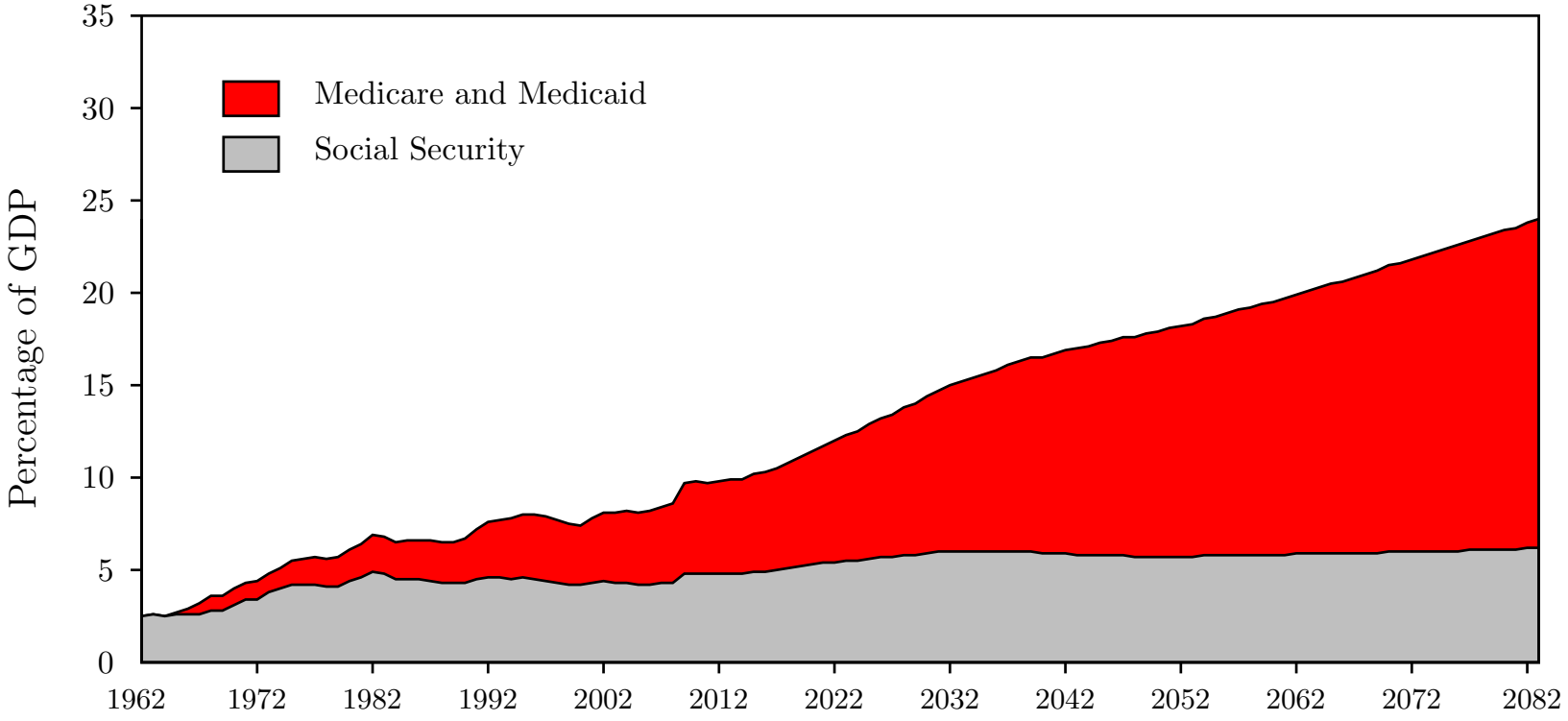
- Profound uncertainty surrounds the funding of future *promised* transfers in the U.S. and major advanced economies

U.S. "UNFUNDED LIABILITIES"



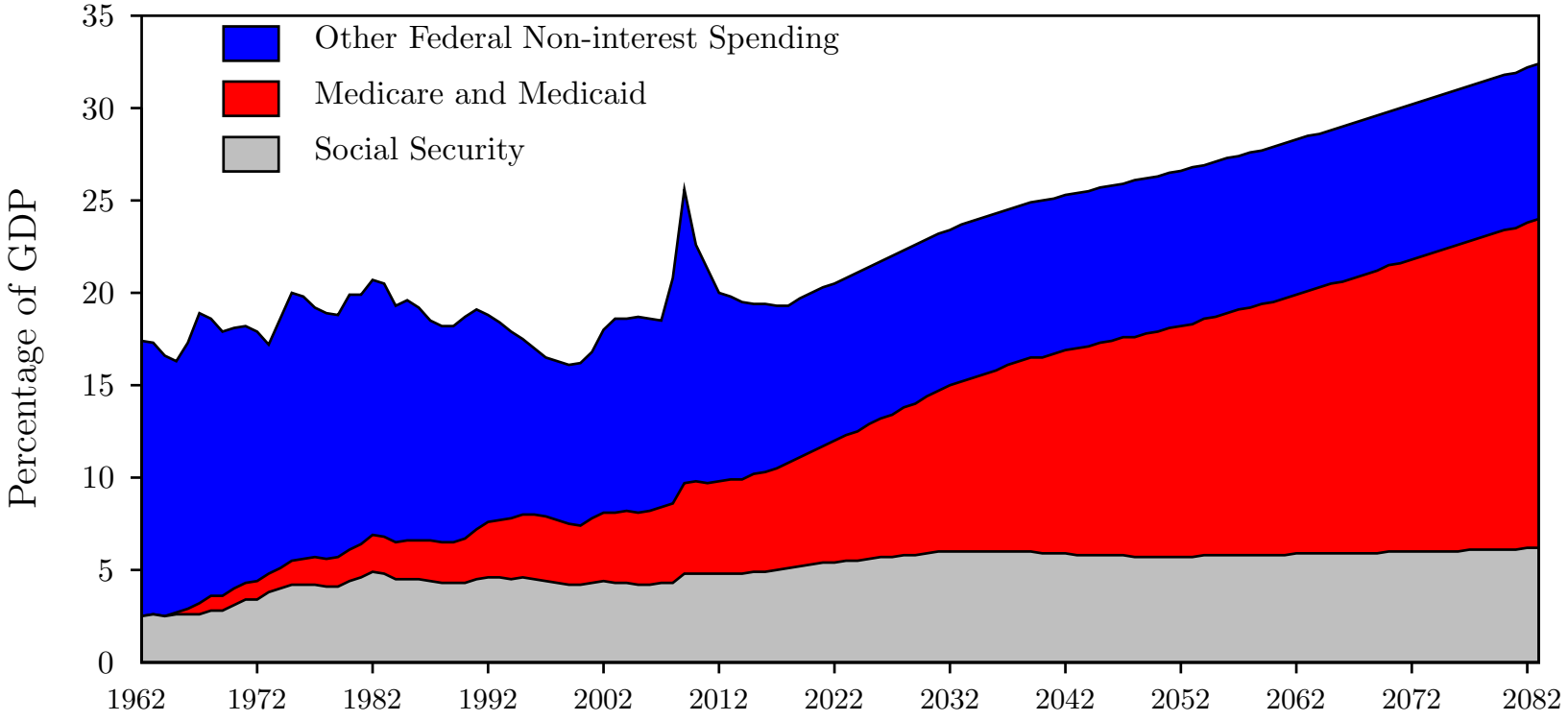
Source: CBO Long-Term Budget Outlook (June 2009)

U.S. "Unfunded Liabilities"



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

U.S. "Unfunded Liabilities"



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

WORLDWIDE "UNFUNDED LIABILITIES"

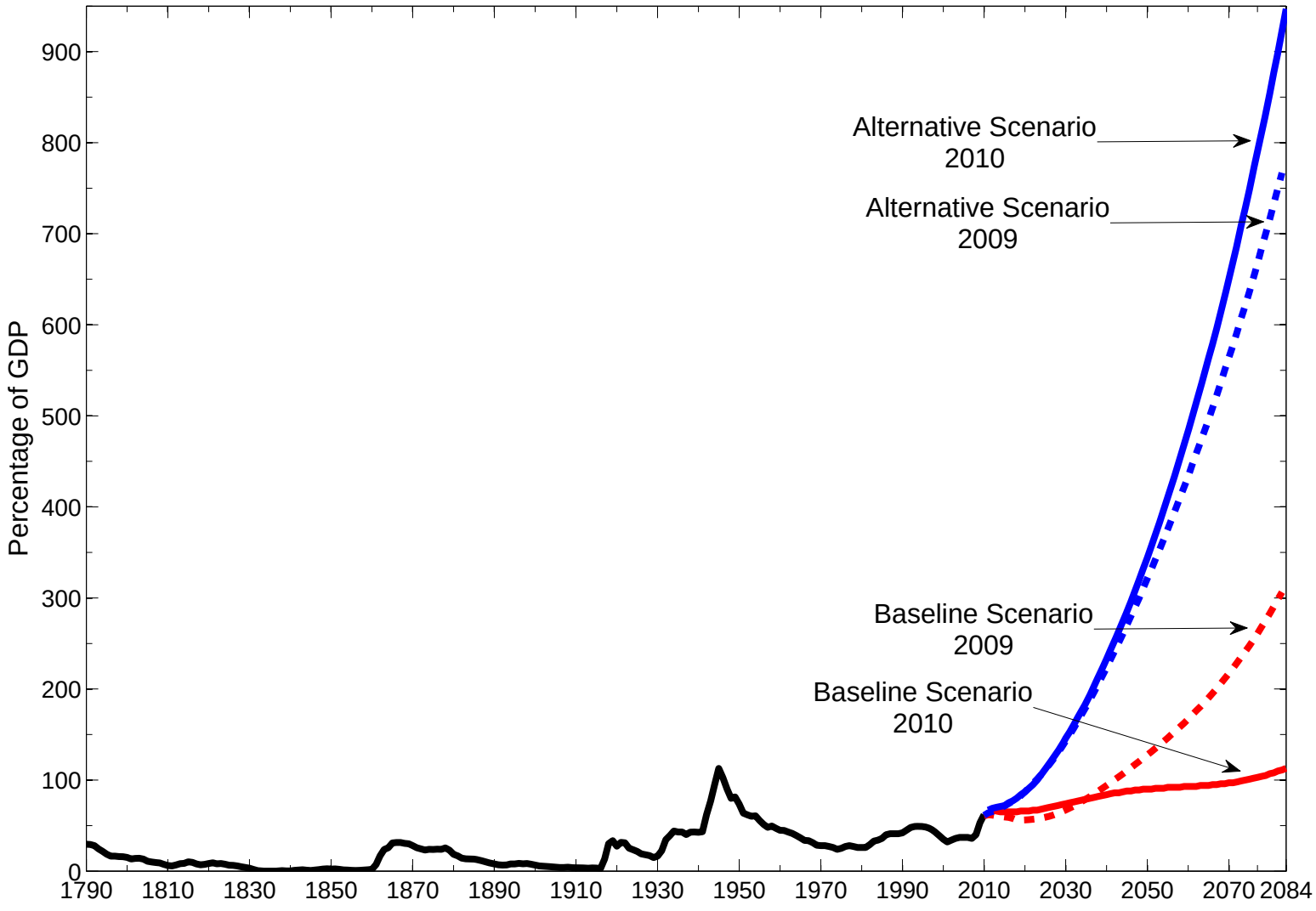
Country	Aging-Related Spending
Australia	482
Canada	726
France	276
Germany	280
Italy	169
Japan	158
Korea	683
Spain	652
United Kingdom	335
United States	495
Advanced G-20 Countries	409

Net present value of impact on fiscal deficit of aging-related spending, in percent of GDP. Source: IMF

Introduction

- Profound uncertainty surrounds the funding of future *promised* transfers in the U.S. and major advanced economies
- **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 Projected Deficits into Debt



Source: CBO Long-Term Budget Outlook (2009 & 2010)

Introduction

- Profound uncertainty surrounds the funding of future *promised* transfers in the U.S. and major advanced economies
- **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

$\Rightarrow$ future policy will change...**how and when?**

WHAT WE DO

- Draws on Davig, Leeper, and Walker (*JME* 2010)
- 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 $\Rightarrow$ Volatile inflation
  4. Inflation financing (printing presses) $\Rightarrow$ Fiscal limit here also (seigniorage Laffer curve)
  5. Outright default $\Rightarrow$ 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 $\Rightarrow$ "Third Rail of Politics"
  2. Distortionary taxation $\Rightarrow$ Fiscal limit
  3. Sacrificing inflation target $\Rightarrow$ 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
- Model fiscal limit as random variable $= f$(fiscal variables)
- Focus on expectational effects in otherwise standard macroeconomic DSGE model

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 μ financed by lump-sum taxes and debt

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

- Government's Budget Constraint:

$$\frac{B_t}{P_t} + \tau_t = z_t + \frac{R_{t-1}B_{t-1}}{P_t}$$

Analytic Intuition: Policy Specification

At time T economy reaches fiscal limit

	Regime 1 $t = 0, 1, \ldots, T-1$	
Monetary Policy	$R_t^{-1} = R^{*-1} + \alpha \left(\frac{P_{t-1}}{P_t} - \frac{1}{\pi^*} \right)$	
Tax Policy	$\tau_t = \tau^* + \gamma \left(\frac{B_{t-1}}{P_{t-1}} - b^* \right)$	

Analytic Intuition: Policy Specification

At time T economy reaches fiscal limit

	Regime 1 $t = 0, 1, \ldots, T-1$	Regime 2 $t = T, T+1, \ldots$
Monetary Policy	$R_t^{-1} = R^{*-1} + \alpha \left(\frac{P_{t-1}}{P_t} - \frac{1}{\pi^*} \right)$	$R_t^{-1} = R^{*-1}$
Tax Policy	$\tau_t = \tau^* + \gamma \left(\frac{B_{t-1}}{P_{t-1}} - b^* \right)$	$\tau_t = \tau^{\max}$

Analytic Intuition: Policy Specification

At time T economy reaches fiscal limit

	Regime 1 $t = 0, 1, \ldots, T-1$	Regime 2 $t = T, T+1, \ldots$
Monetary Policy	$R_t^{-1} = R^{*-1} + \alpha \left(\frac{P_{t-1}}{P_t} - \frac{1}{\pi^*} \right)$	$R_t^{-1} = R^{*-1}$
Tax Policy	$\tau_t = \tau^* + \gamma \left(\frac{B_{t-1}}{P_{t-1}} - b^* \right)$	$\tau_t = \tau^{\max}$

Fiscal limit may be *economic* (peak of Laffer curve) or *political* (intolerance of taxation)

Analytic Intuition: Polar Case 1

If Regime 1 were absorbing state (No Fiscal Limit)

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

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

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

A Standard Monetary Equilibrium

Analytic Intuition: Polar Case 2

If Regime 2 were absorbing state

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

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

$\alpha = 0$, $\gamma = 0 \Rightarrow$ 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

	$t = 0, 1, \ldots, T-1$	$t = T, T+1, \ldots$
Monetary Policy	$R_t^{-1} = R^{*-1} + \alpha \left(\frac{P_{t-1}}{P_t} - \frac{1}{\pi^*} \right)$	same
Tax Policy	$\tau_t = \tau^* + \gamma \left(\frac{B_{t-1}}{P_{t-1}} - b^* \right)$	$\tau_t = \tau^{\max}$
Transfer Policy	z_t	$\lambda_t z_t$

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

λ_t adjusts to stabilize debt

$$\pi_t = \pi^*$$

A Standard Monetary Equilibrium

FISCAL LIMIT: NO RENEGING

	$t = 0, 1, \ldots, T-1$	$t = T, T+1, \ldots$
Monetary Policy	$R_t^{-1} = R^{*-1} + \alpha \left(\frac{P_{t-1}}{P_t} - \frac{1}{\pi^*} \right)$	$R_t^{-1} = R^{*-1}$
Tax Policy	$\tau_t = \tau^* + \gamma \left(\frac{B_{t-1}}{P_{t-1}} - b^* \right)$	$\tau_t = \tau^{\max}$
Transfer Policy	z_t	same

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

$$P_t = f(z_t; \gamma, \mu, \beta, \pi^*)$$

A New Fiscal Equilibrium Before the Limit

FISCAL LIMIT: NO RENEGING ANALYTICS

$$\frac{B_0}{P_0} = E_0 \sum_{j=1}^{\infty} \beta^j s_j$$

$$= E_0 \sum_{j=1}^{T-1} \beta^j s_j + \left(\frac{1}{1-\beta\gamma} \right)^{T-1} E_0 \sum_{j=T}^{\infty} \beta^j s_j$$

$$s_t = \begin{cases} \tau^* - \gamma(B_{t-1}/P_{t-1} - b^*) - z_t, & t = 0, 1, ..., T-1 \\ \tau^{\max} - z_t, & t = T, ..., \infty \end{cases}$$

FISCAL LIMIT: NO RENEGING ANALYTICS

Evaluate sum from 1 to $T-1$

$$E_0 \sum_{j=1}^{T-1} \beta^j s_j = (\tau^* - \gamma b^* - z^*) \sum_{j=1}^{T-1} \left(\frac{\beta}{1-\gamma\beta} \right)^j - (z_0 - z^*) \sum_{j=1}^{T-1} \left(\frac{\beta\mu}{1-\gamma\beta} \right)^j$$

Evaluate sum from T to ∞, letting $\tau^{\max} = \tau^*$

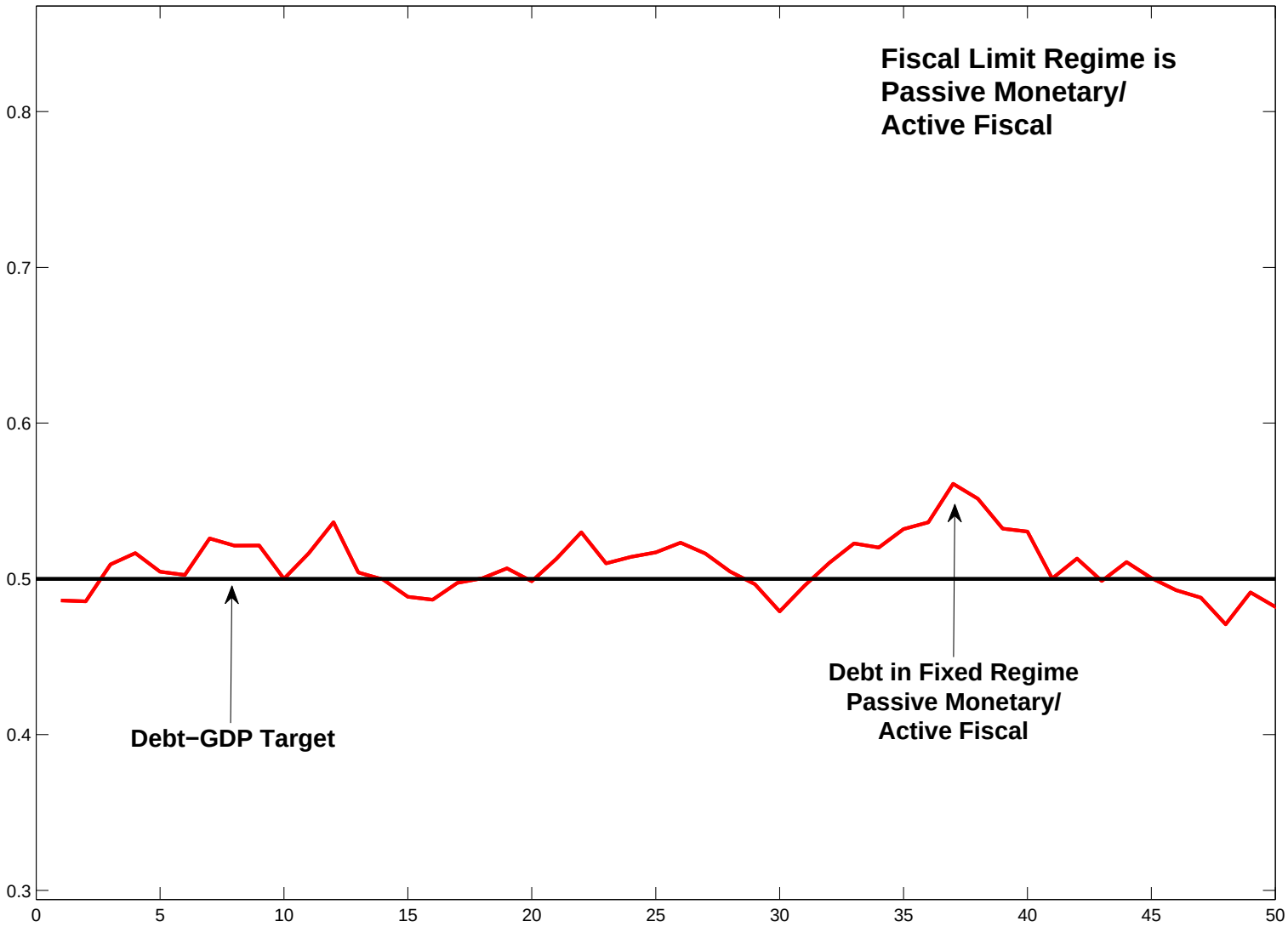
$$E_0 \sum_{j=T}^{\infty} \beta^j s_j = E_0 \left(\frac{B_{T-1}}{P_{T-1}} \right) = \frac{\beta^T}{1-\beta}(\tau^* - z^*) - \frac{(\beta\mu)^T}{1-\beta\mu}(z_0 - z^*)$$

FISCAL LIMIT: NO RENEGING ANALYTICS

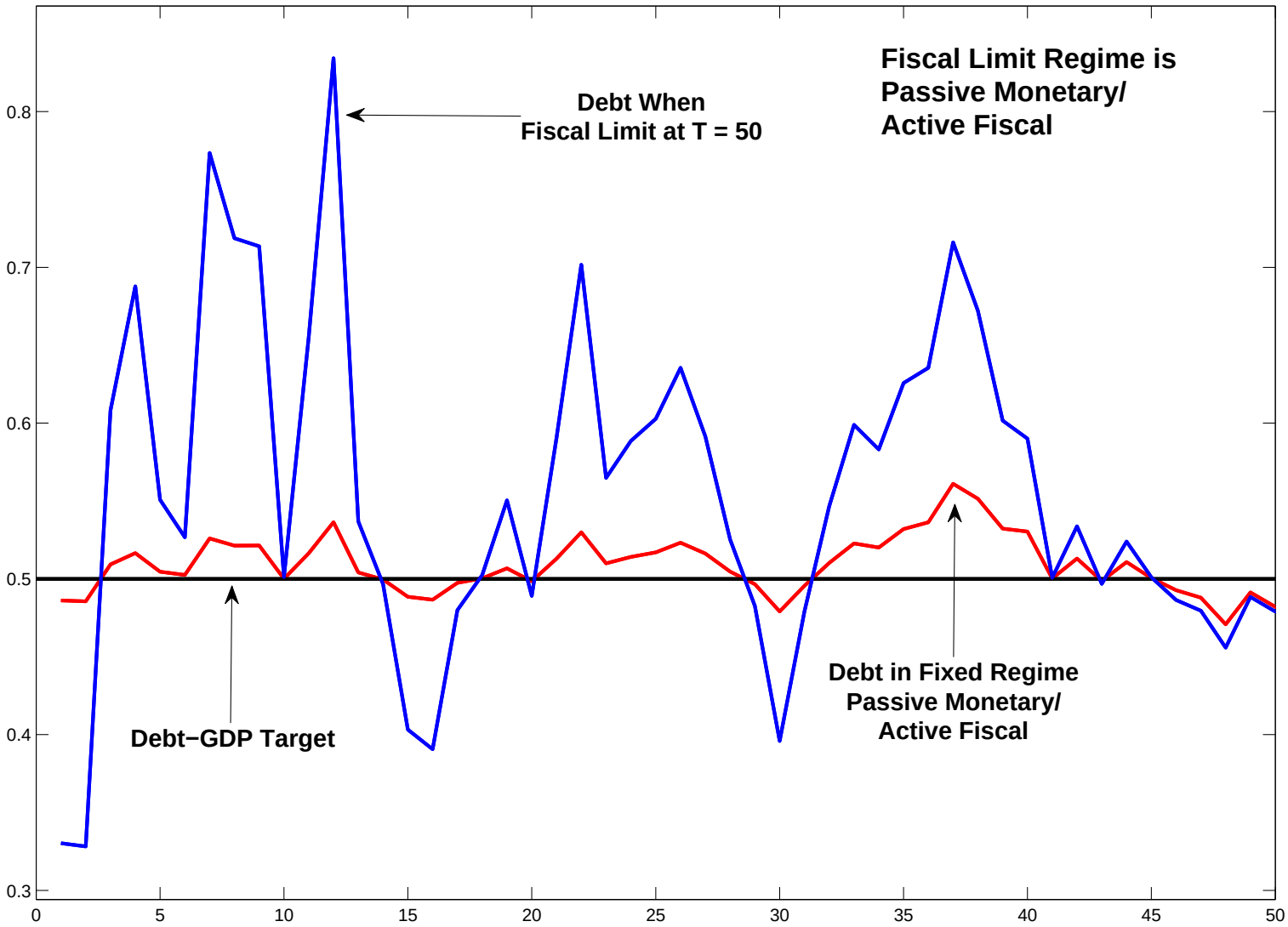
Pulling it together...

$$\frac{B_0}{P_0} = \left[\left(\frac{1}{1-\beta\gamma}\right)^{T-1}\frac{\beta^T}{1-\beta} + \sum_{j=1}^{T-1}\left(\frac{\beta}{1-\gamma\beta}\right)^j\right](\tau^* - z^*)$$
$$- \gamma b^* \sum_{j=1}^{T-1}\left(\frac{\beta}{1-\gamma\beta}\right)^j$$
$$- \left[\left(\frac{1}{1-\beta\gamma}\right)^{T-1}\frac{(\beta\mu)^T}{1-\beta\mu} + \sum_{j=1}^{T-1}\left(\frac{\beta\mu}{1-\gamma\beta}\right)^j\right](z_0 - z^*)$$

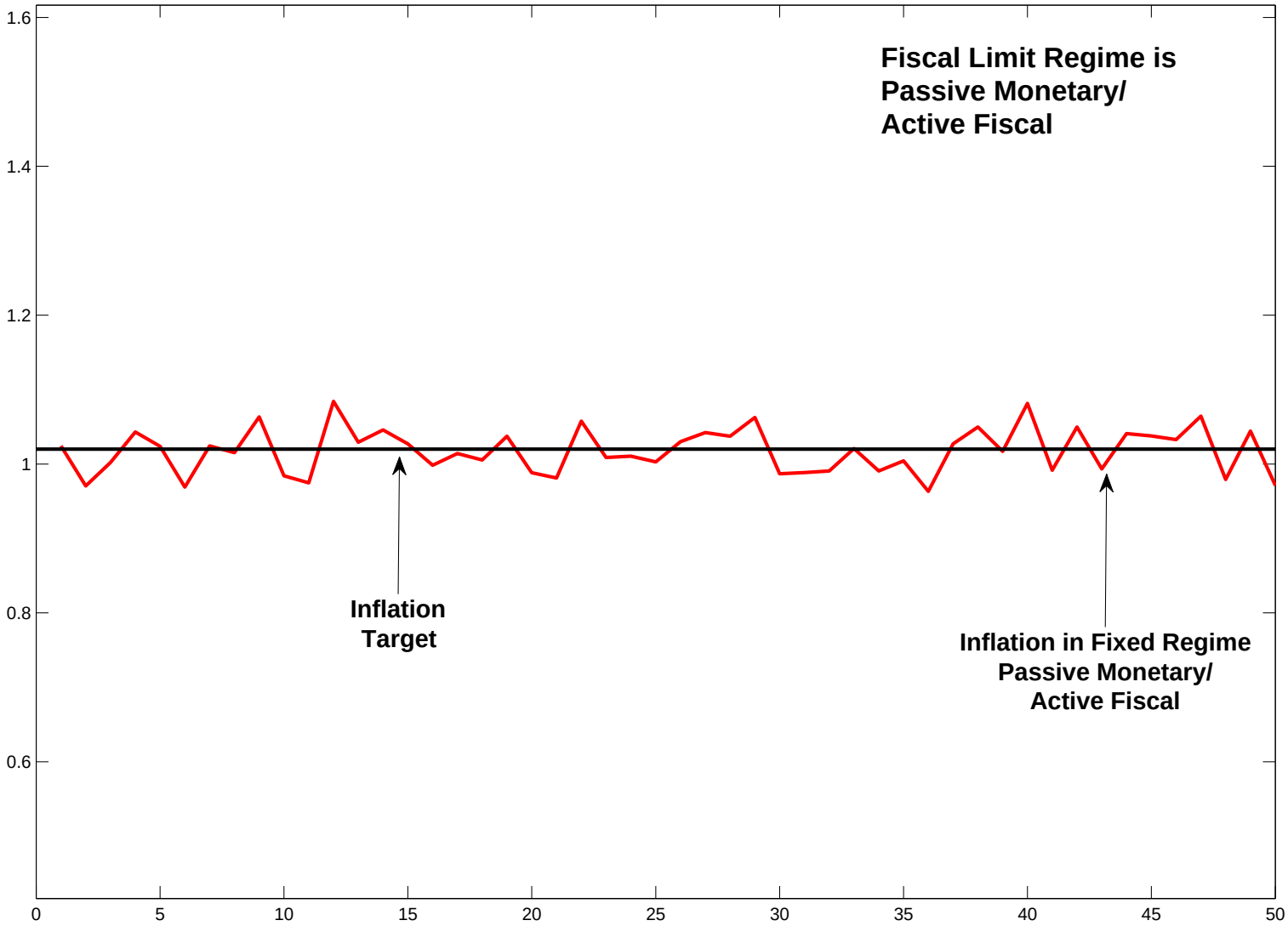
Analytic Intuition: Debt



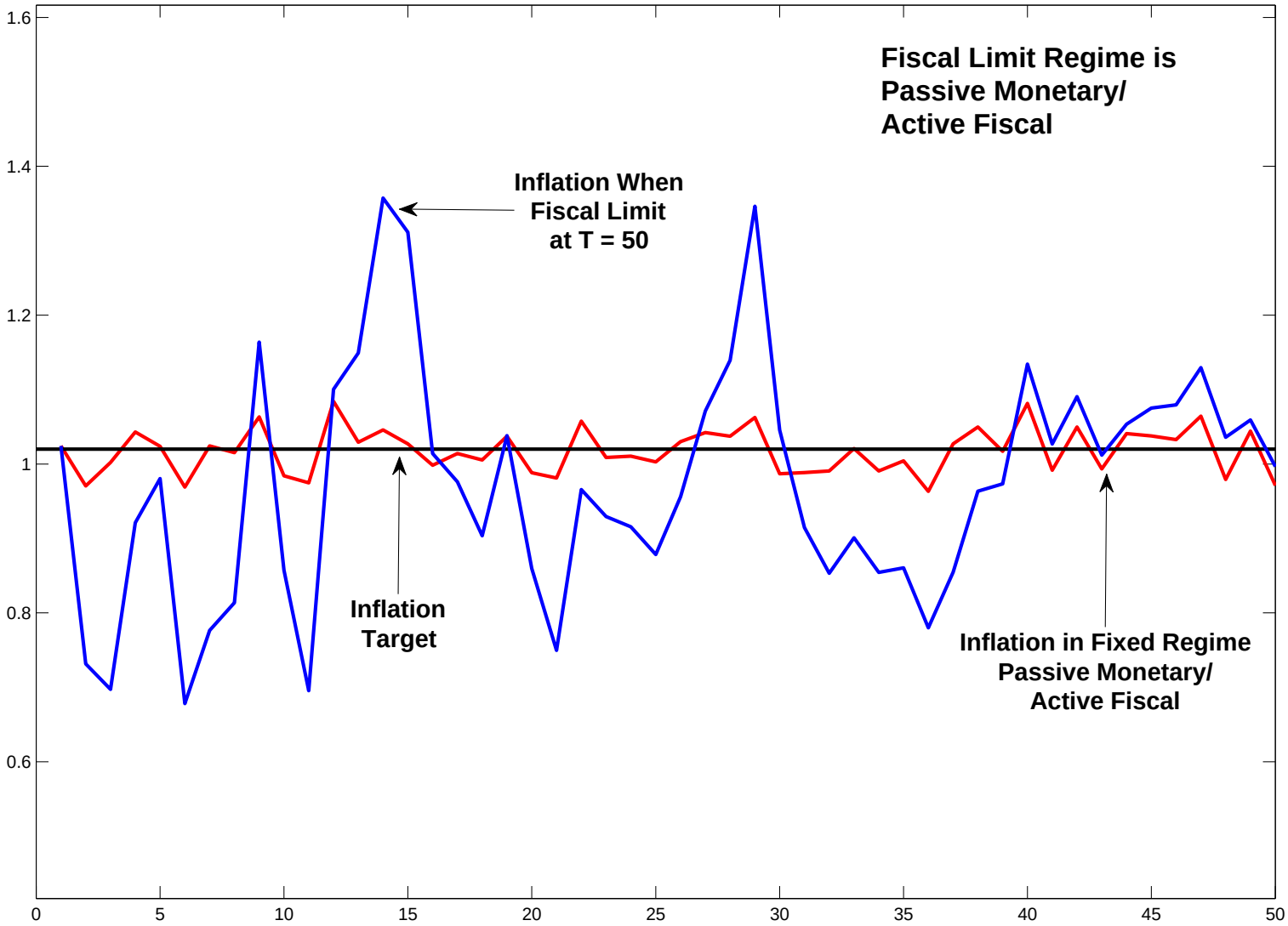
Analytic Intuition: Debt



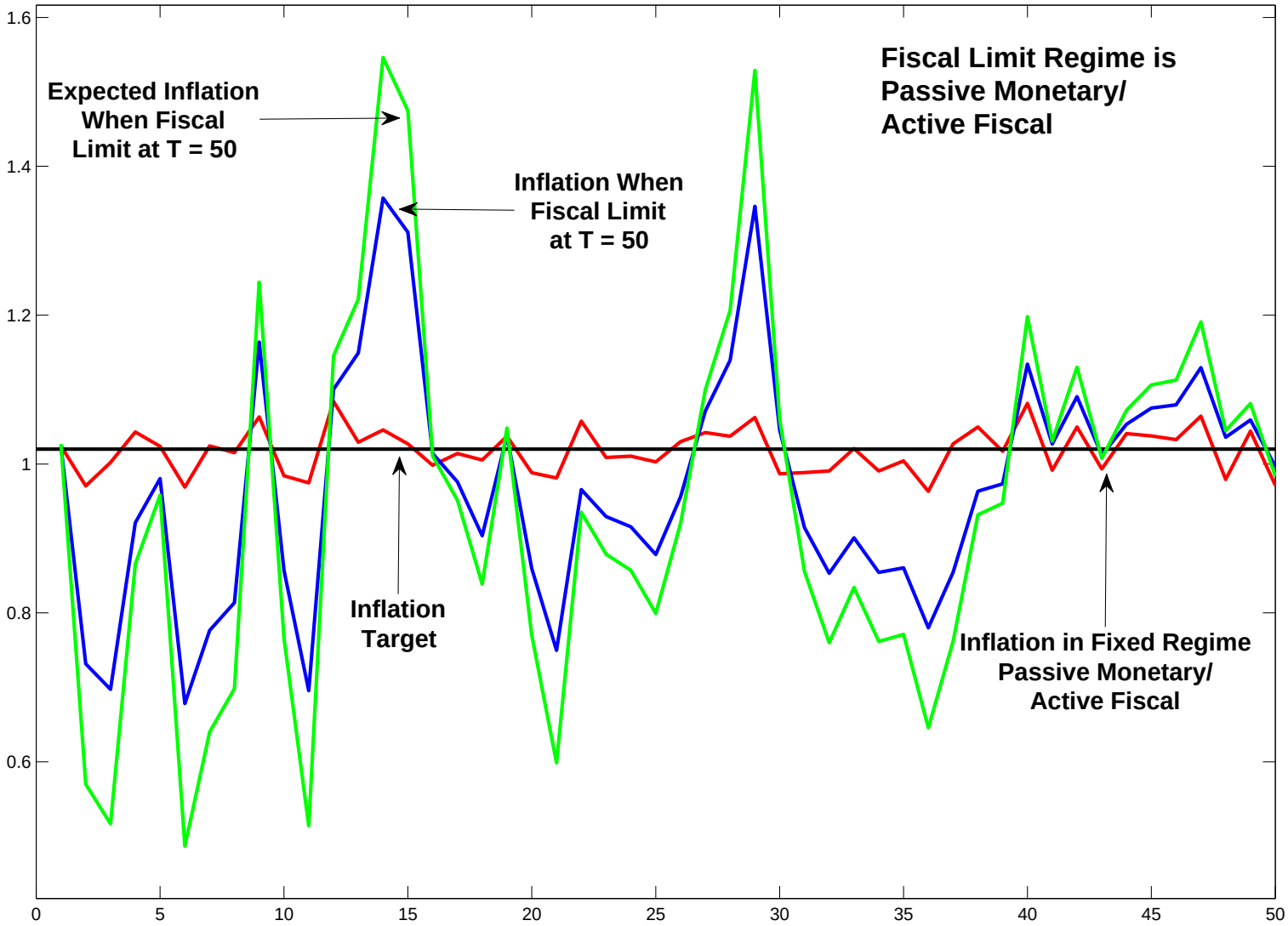
Analytic Intuition: Inflation



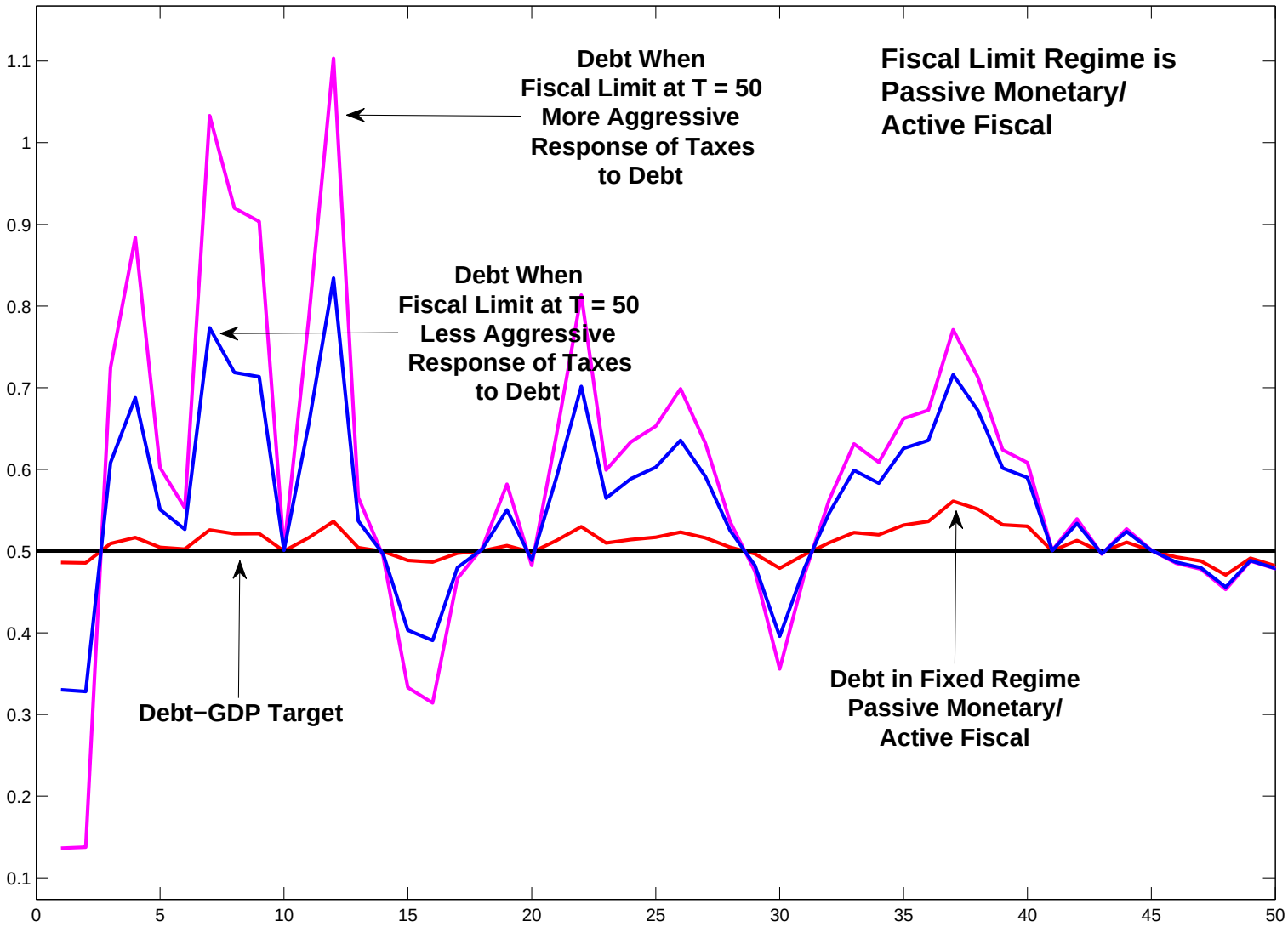
Analytic Intuition: Inflation



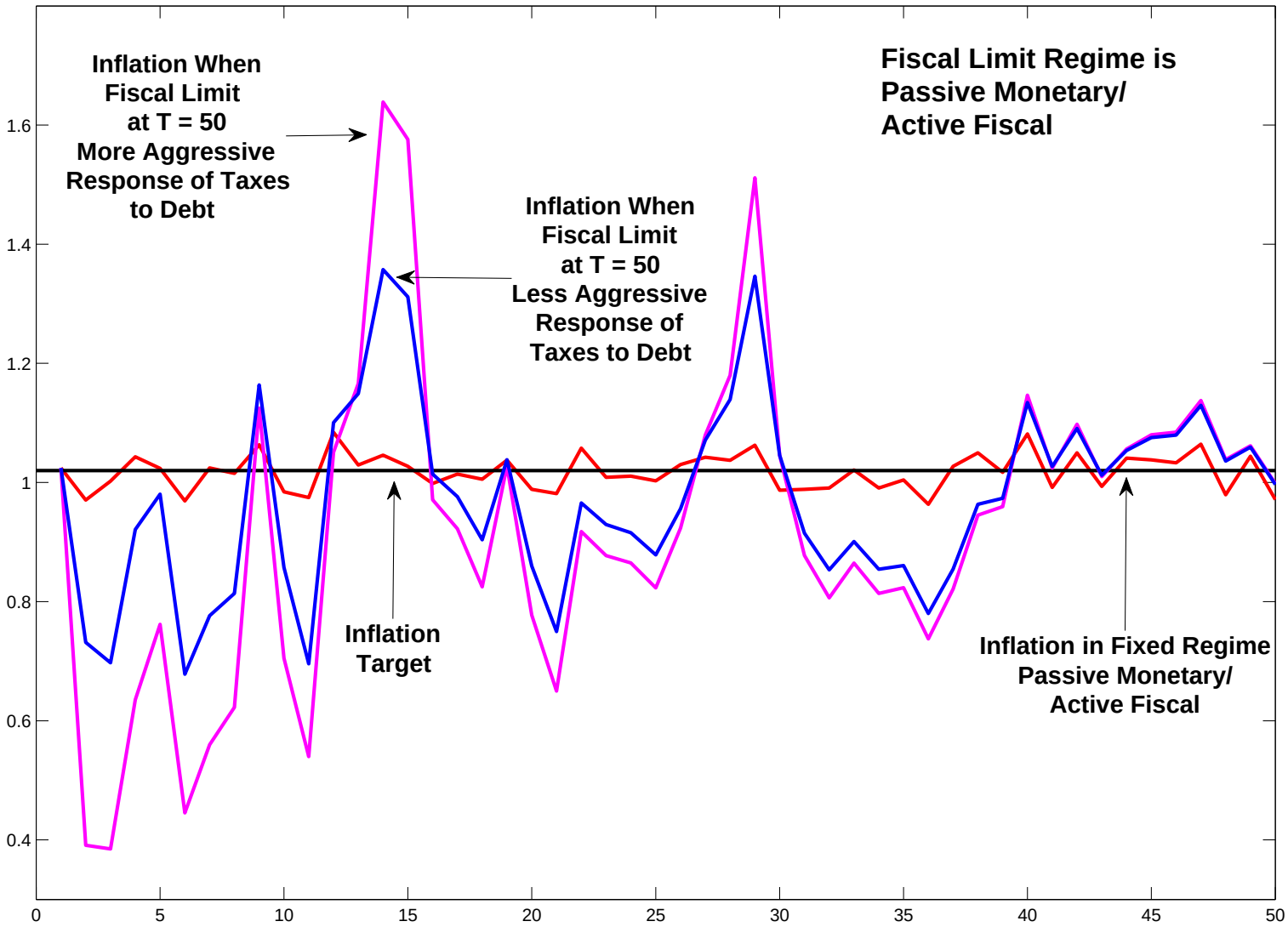
Analytic Intuition: Expected Inflation



Stronger Response of Taxes to Debt



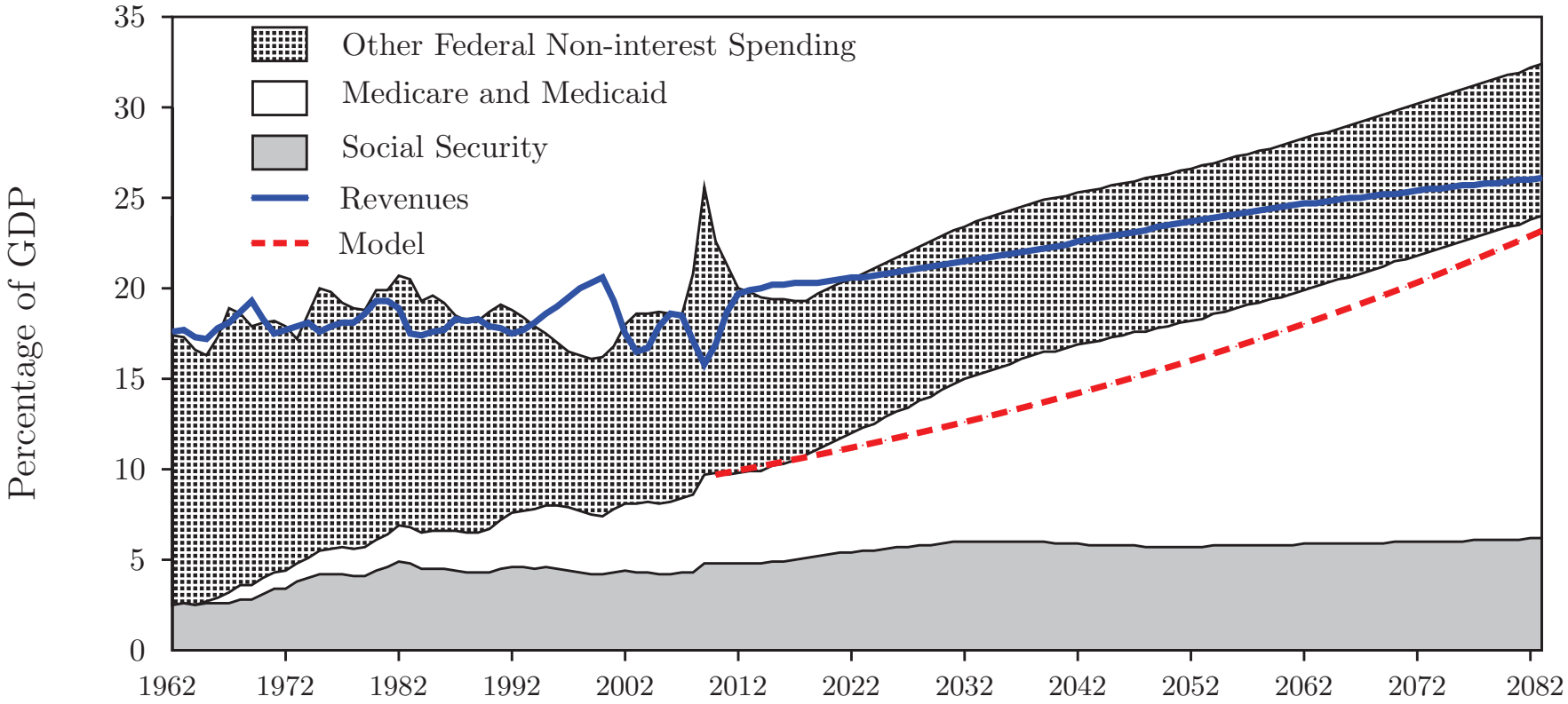
Stronger Response of Taxes to Debt



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
- More aggressive inflation or debt targeting pre-limit raises instability

Promised Transfers in a DSGE 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

$$C_t + K_t + \frac{B_t}{P_t} + \frac{M_t}{P_t} \leq (1-\tau_t)\left(\frac{W_t}{P_t}N_t + R_t^k K_{t-1}\right)$$

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

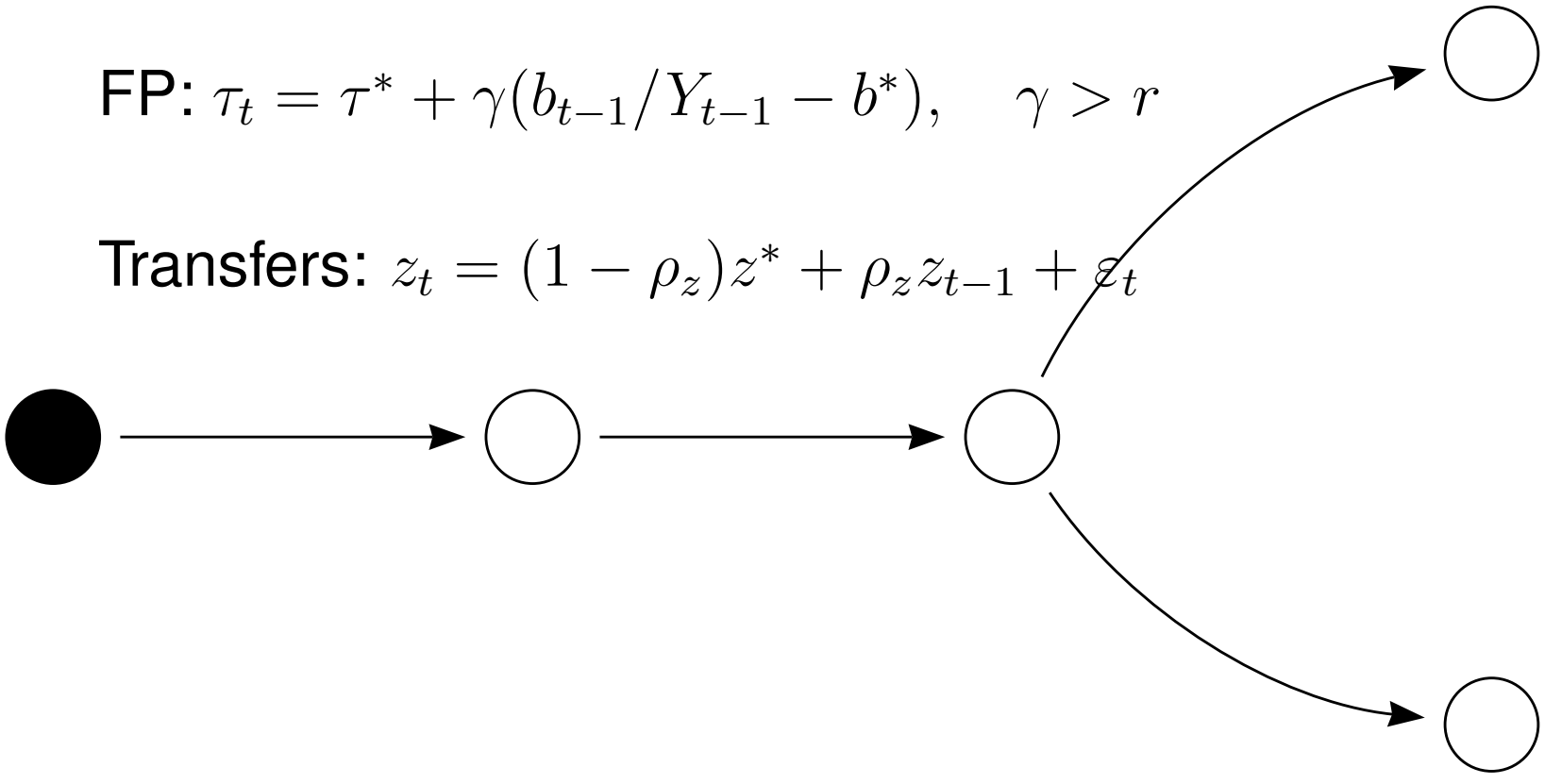
- Firms set prices as a markup over marginal costs (Rotemberg costly adjustment)

INITIAL PERIOD: STATIONARY TRANSFERS

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

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

Transfers: $z_t = (1 - \rho_z)z^* + \rho_z z_{t-1} + \varepsilon_t$

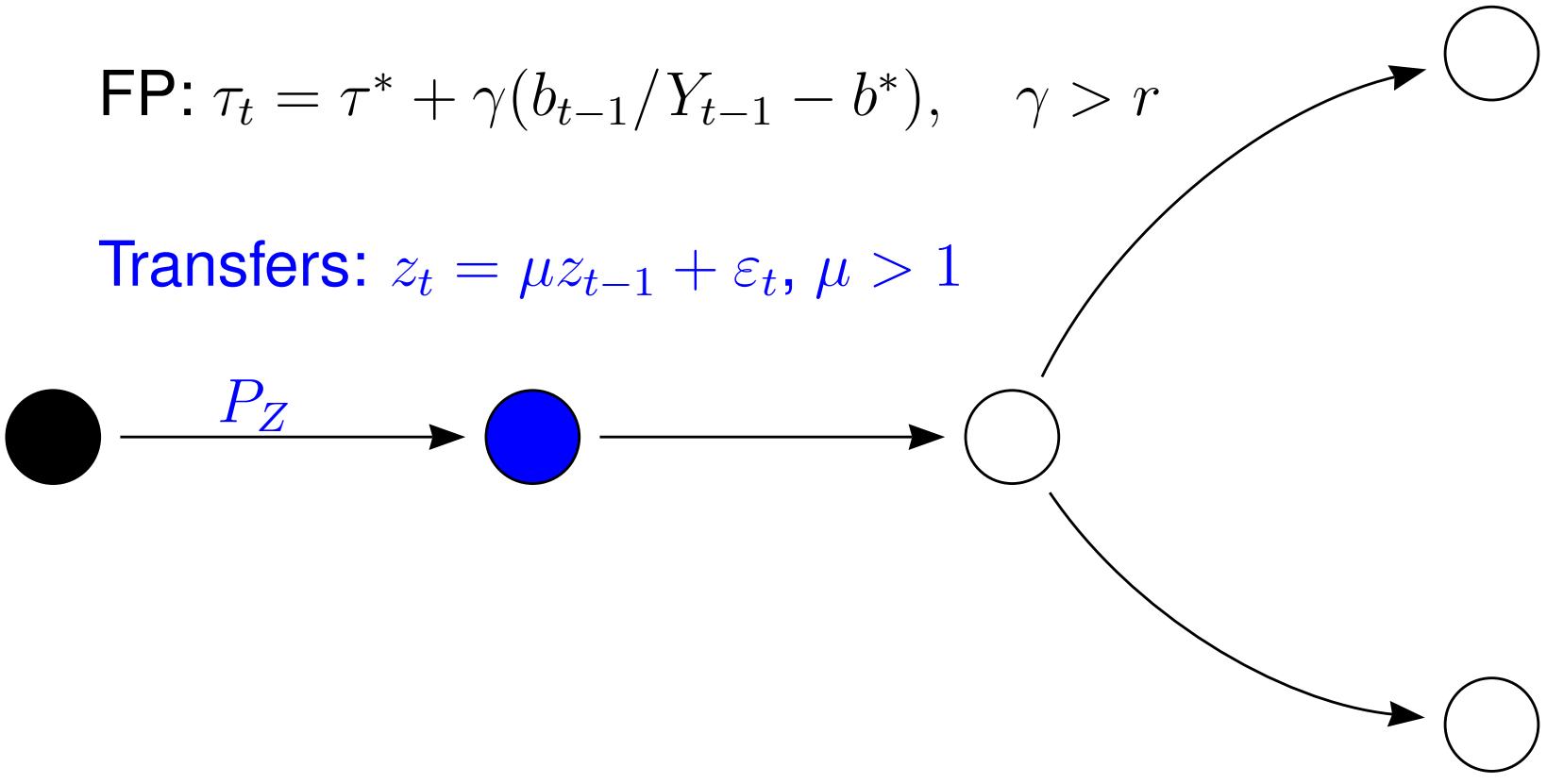


NON-STATIONARY *Promised* TRANSFERS

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

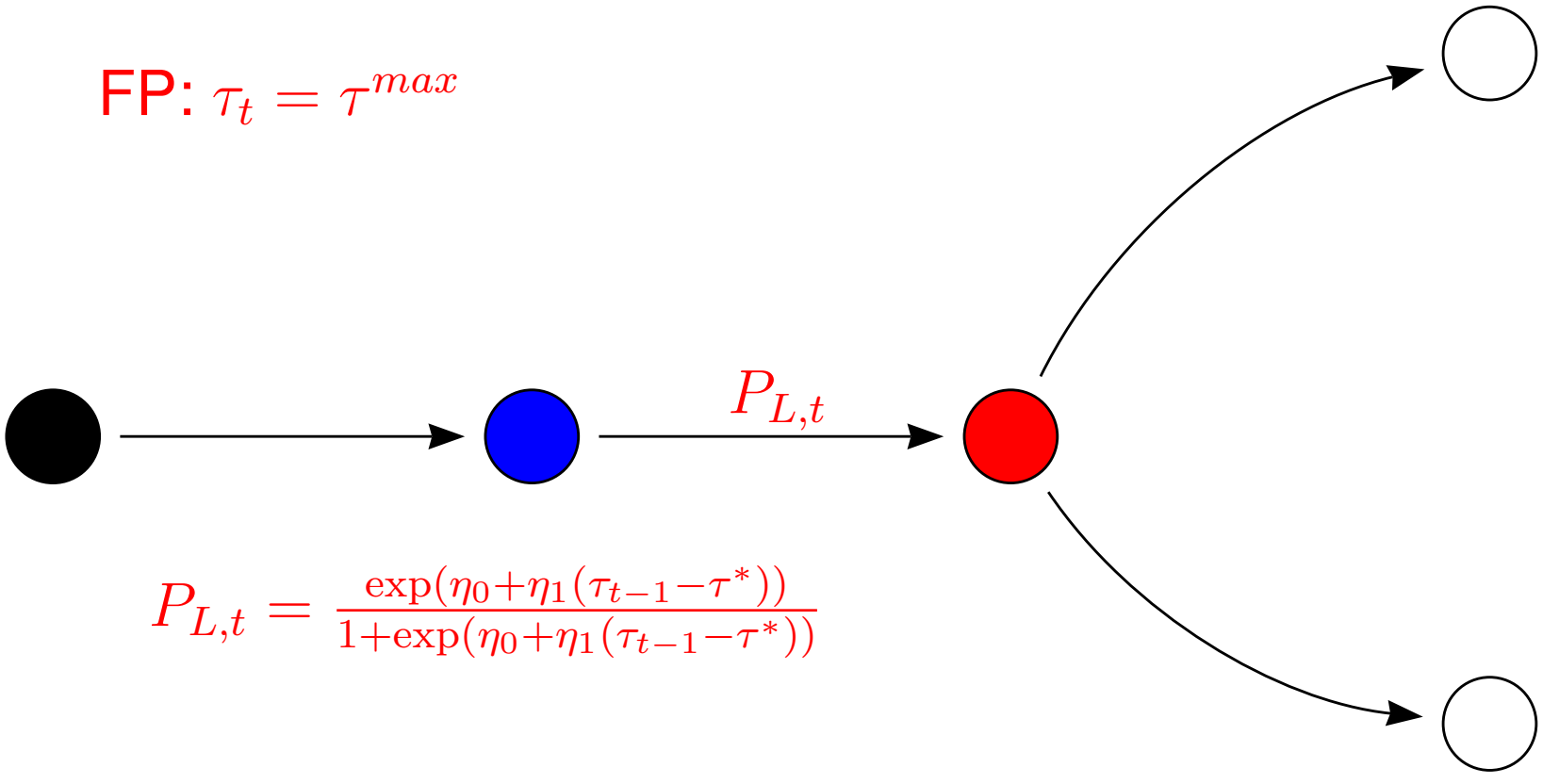
FP: $\tau_t = \tau^* + \gamma(b_{t-1}/Y_{t-1} - b^*), \quad \gamma > r$

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



Fiscal Limit

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



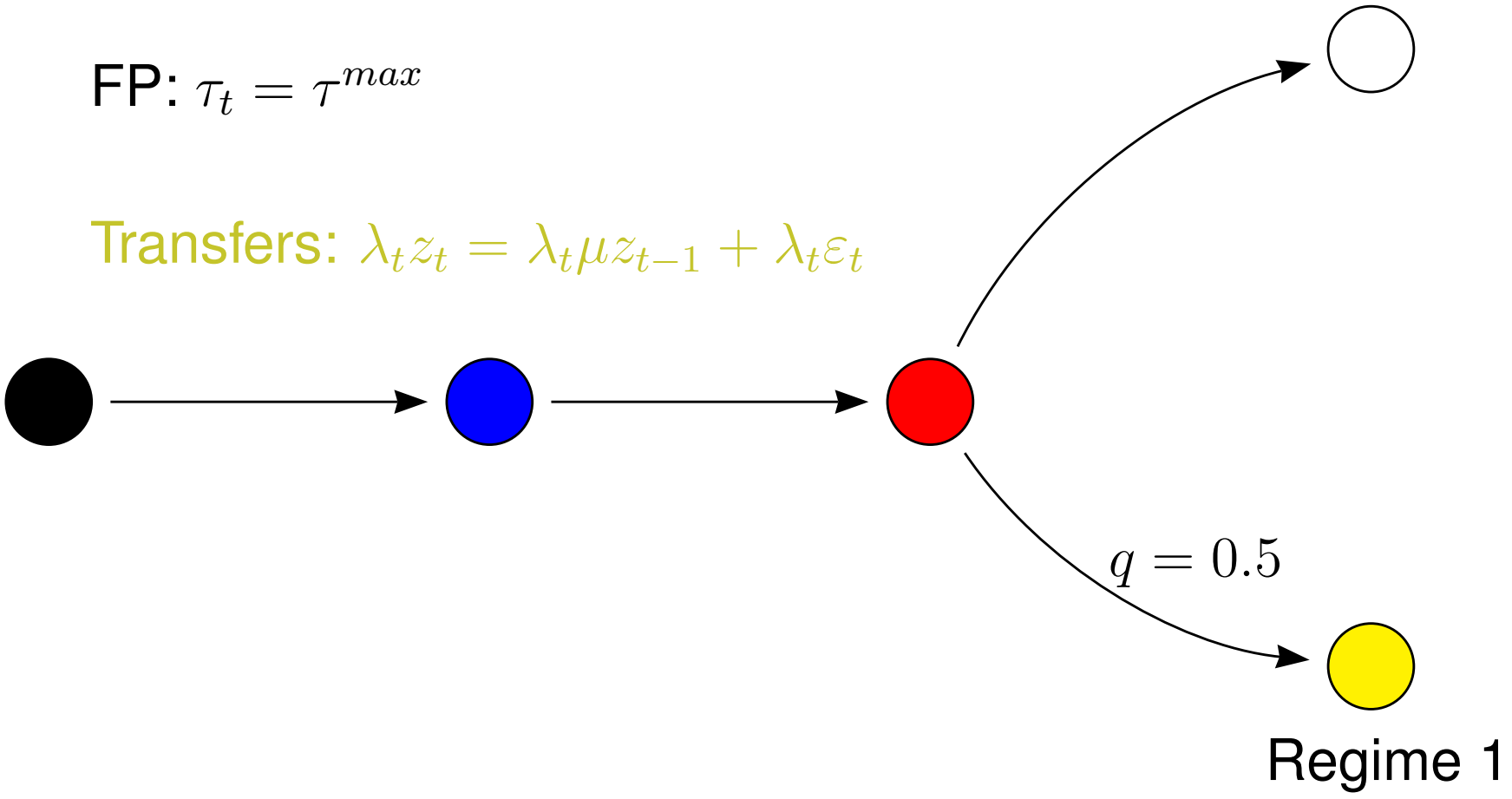
$$P_{L,t} = \frac{\exp(\eta_0 + \eta_1(\tau_{t-1} - \tau^*))}{1 + \exp(\eta_0 + \eta_1(\tau_{t-1} - \tau^*))}$$

FISCAL LIMIT: REGIME 1 AM/AF/PT

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

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

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

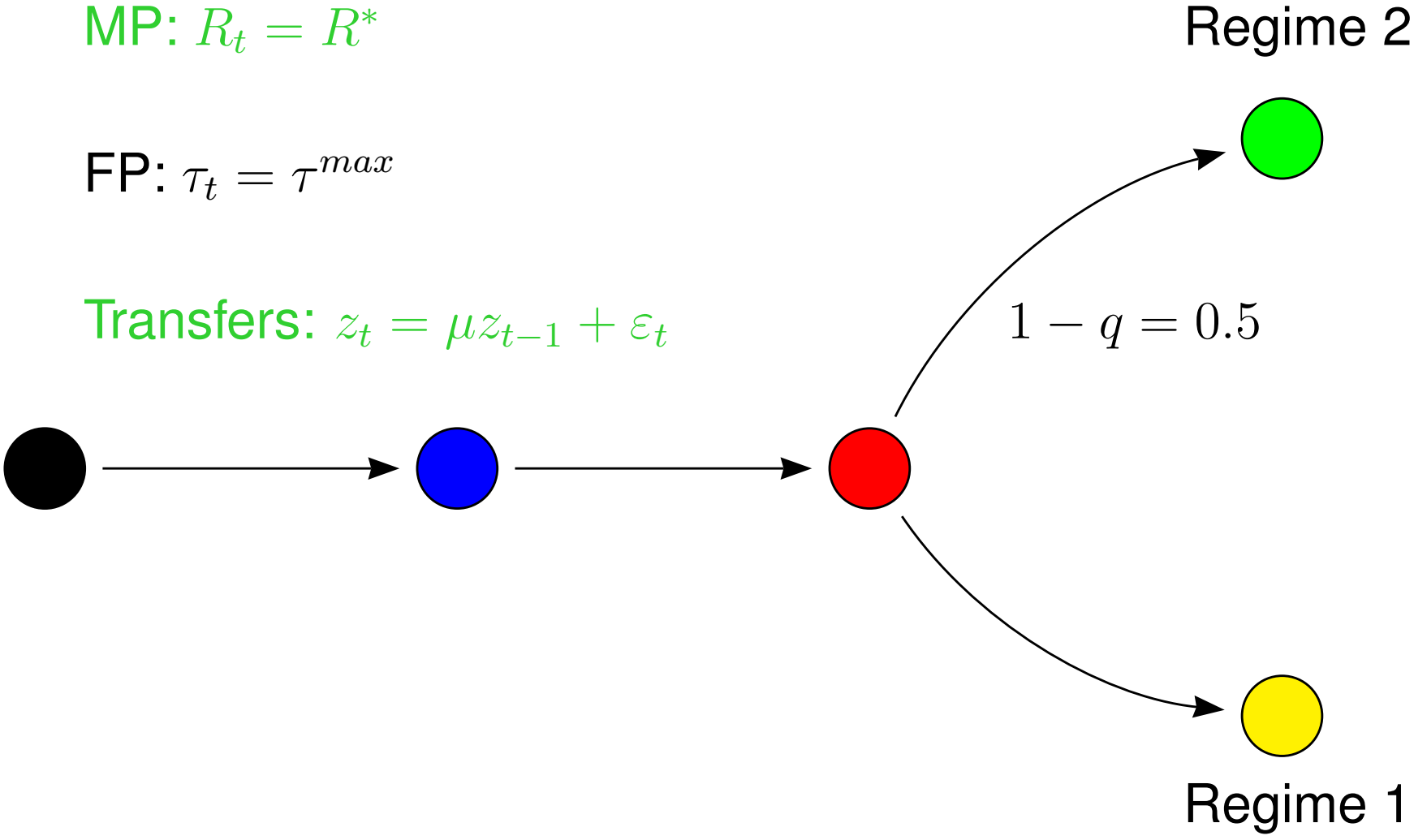


FISCAL LIMIT: REGIME 2 PM/AF/AT

MP: $R_t = R^*$

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

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

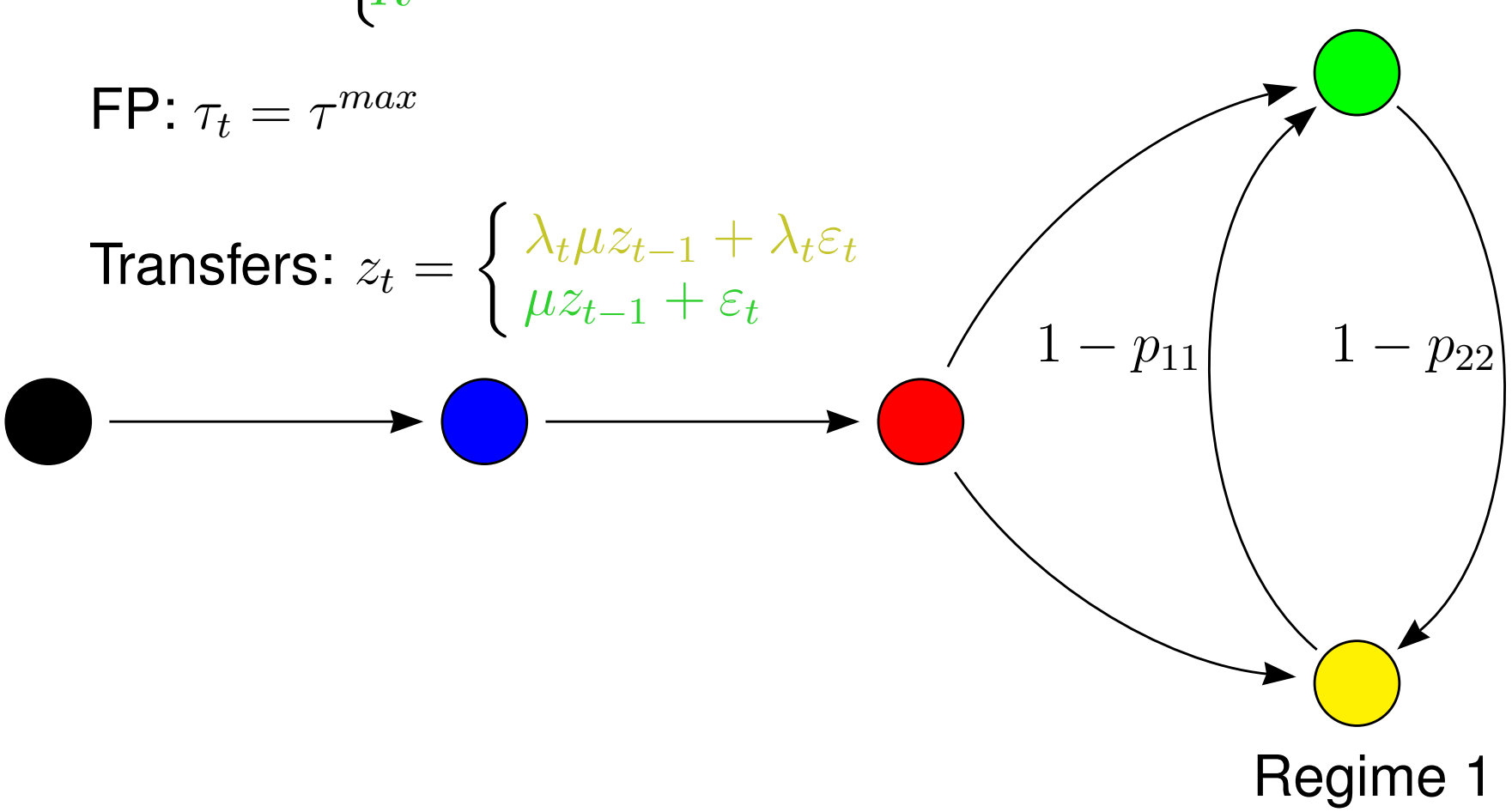


FISCAL LIMIT: SWITCH BETWEEN REGIMES

MP: $R_t = \begin{cases} R^* + \alpha(\pi_t - \pi^*), & \alpha > 1/\beta \\ R^* \end{cases}$

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

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



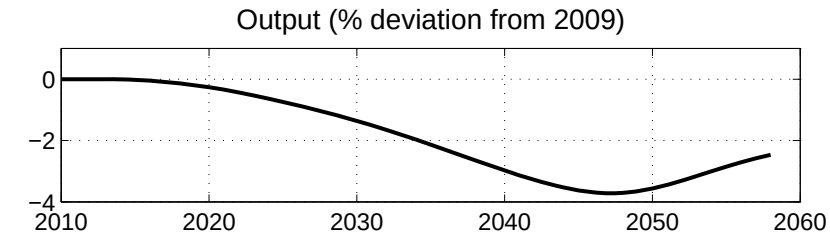
Counterfactual Experiments

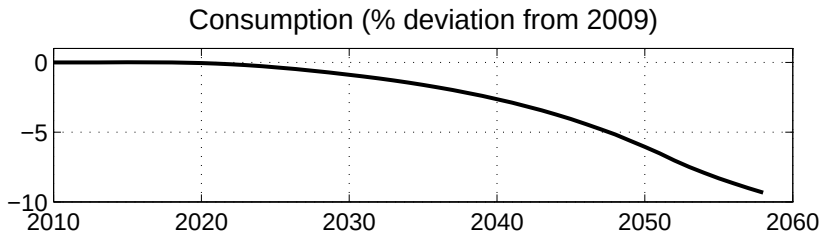
- Layers of uncertainty call for a probabilistic description of outcomes
- Report equilibrium transition paths conditional on *particular* realizations of policies
    - decision rules based on true probability distributions
    - agents always place probability on alternative future regimes
    - these are counterfactual exercises that induce policy regime *surprises* every period

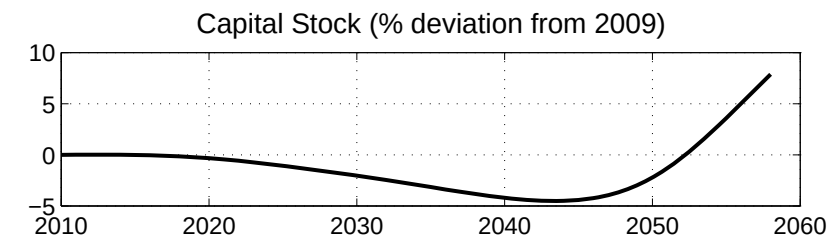
Pre-Limit as Transfers Grow

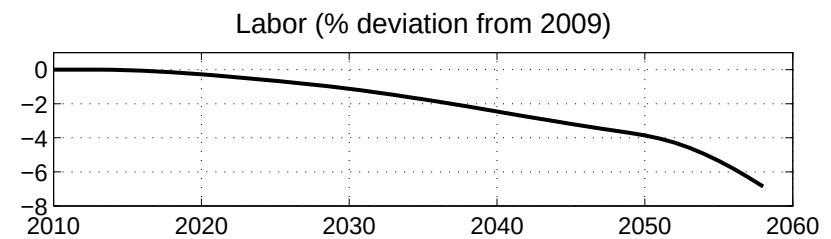
- Dominant forces are rising debt and taxes
- Rising tax rates discourage labor effort and reduce consumption
- Inflection point in dynamics arises at limit, τ^{max}
- Capital falls when $\tau_t < \tau^{max}$, then rises when $\tau_t > \tau^{max}$, in expectation of a future reduction in tax rates

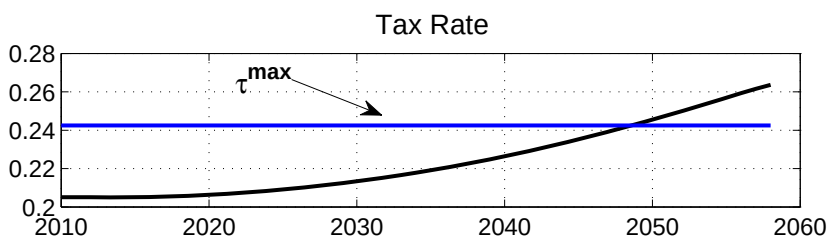
Pre-Limit as Transfers Grow

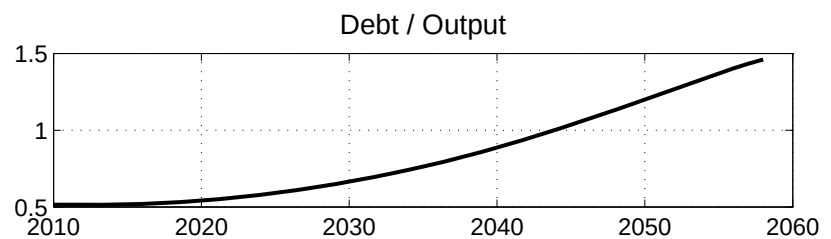


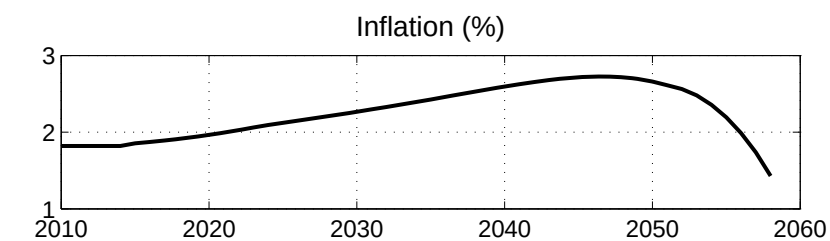


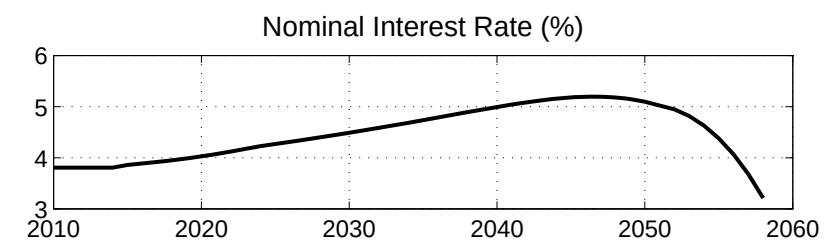








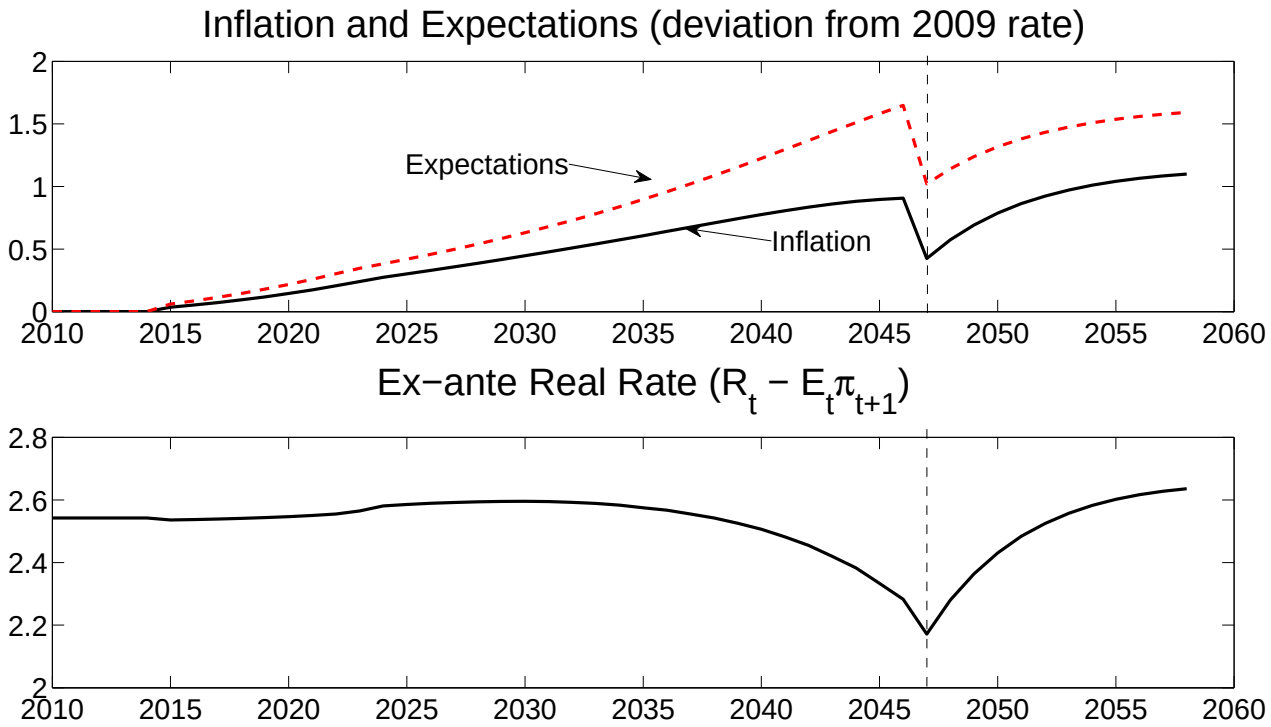




Conditional on *not* triggering fiscal limit

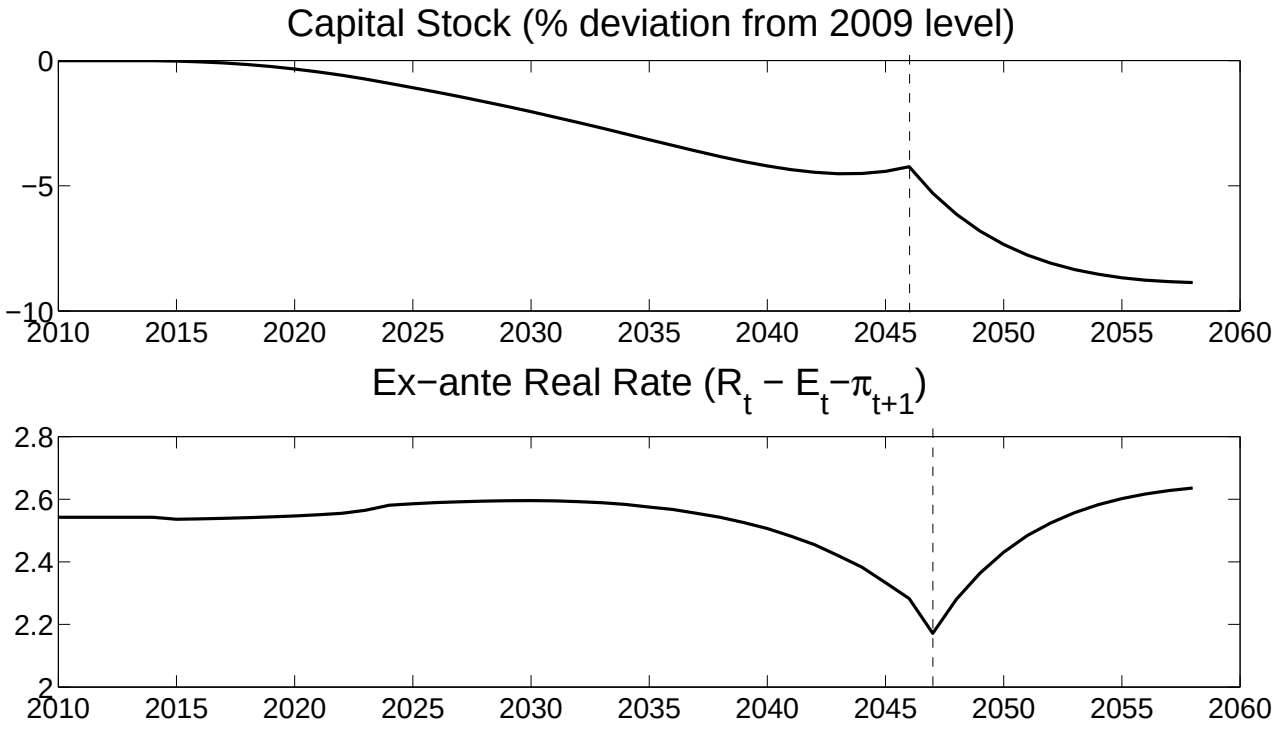
POST-LIMIT RENEGING ($\lambda_t < 1$)

- Monetary policy is active, but can't stabilize inflation
- Agents believe can return to regime without reneging, but with passive monetary policy $\Rightarrow E_t\pi_{t+k}$ rises while R_t falls in response to drop in π_t



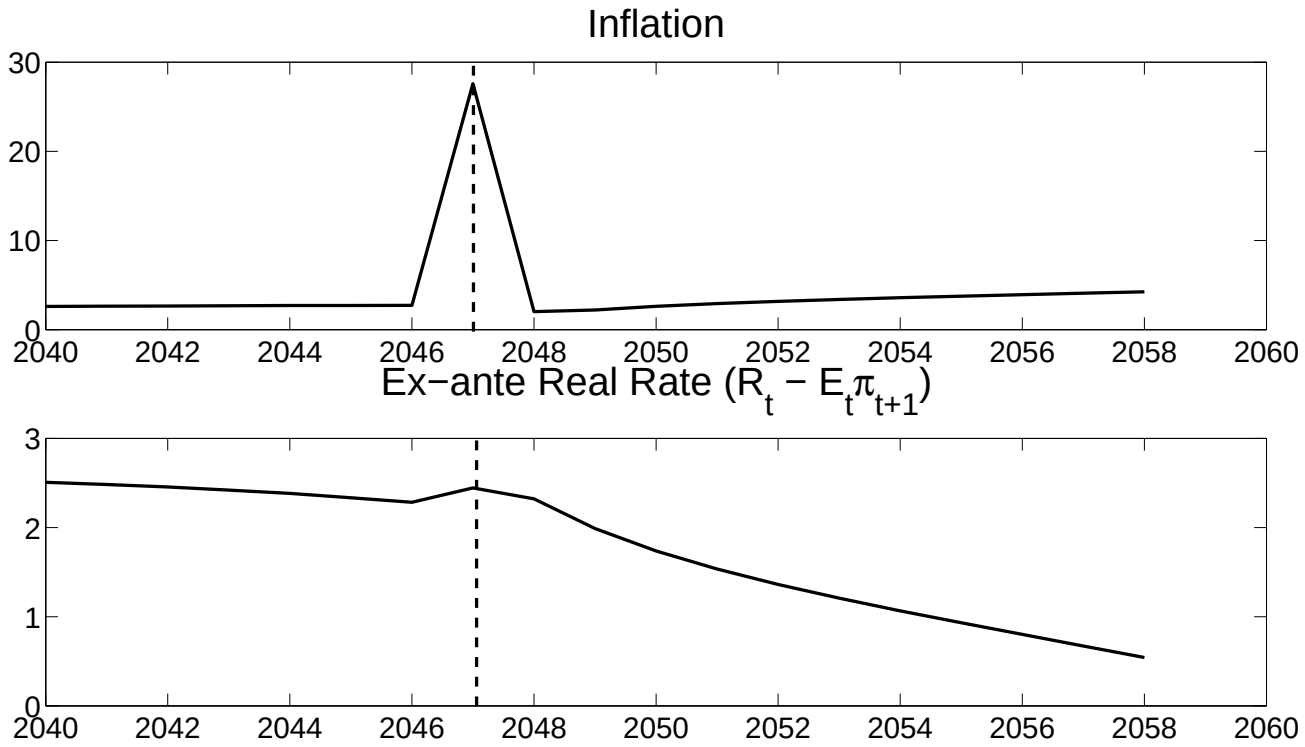
POST-LIMIT RENEGING ($\lambda_t < 1$)

- Low real rates reduce savings & increase consumption
- Capital stock declines



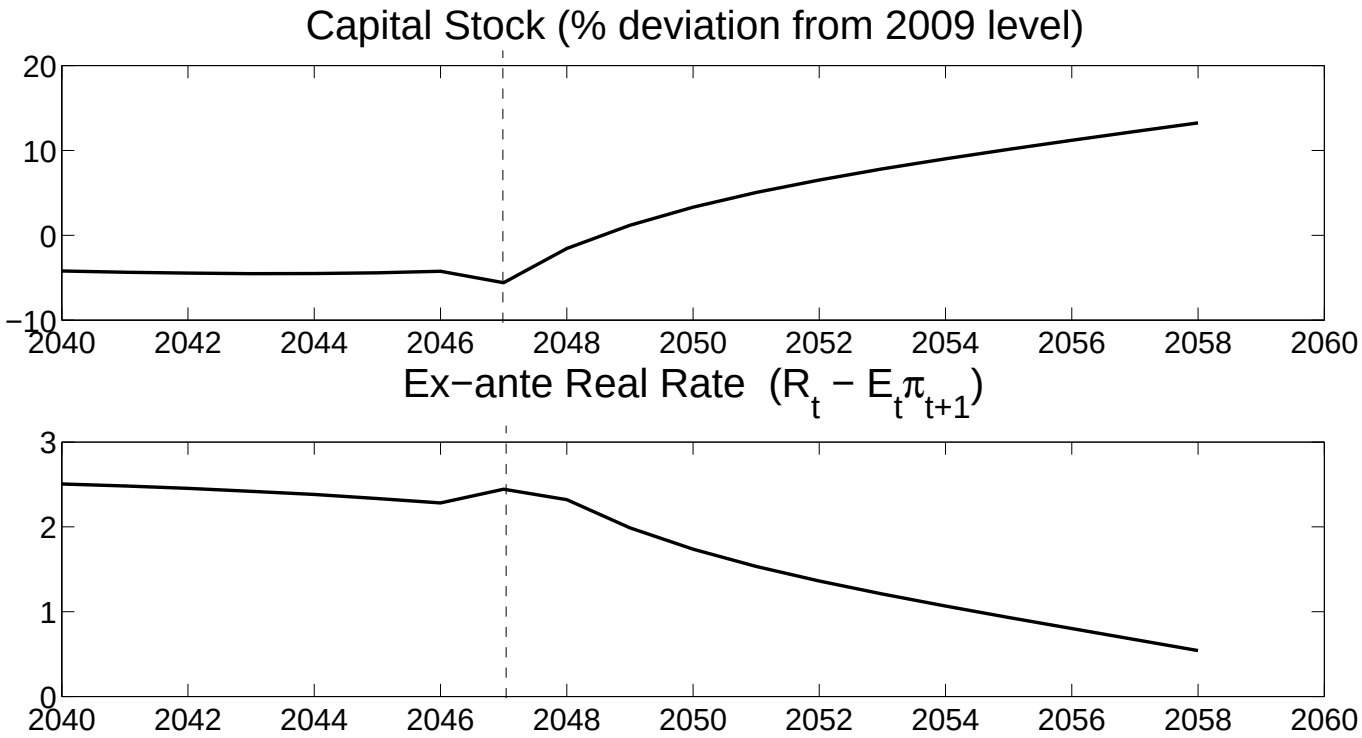
POST-LIMIT PASSIVE MONETARY POLICY

- Monetary policy is passive and $\lambda_t = 1$
- Agents still believe can move to reneging regime



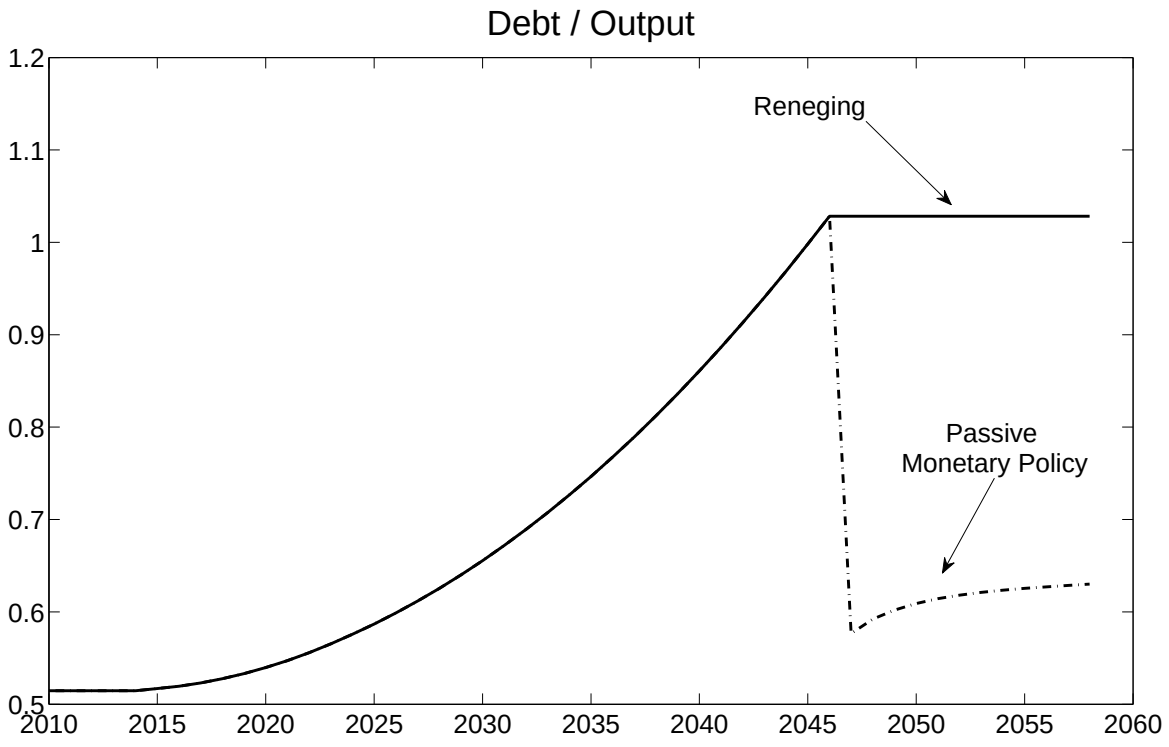
POST-LIMIT PASSIVE MONETARY POLICY

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

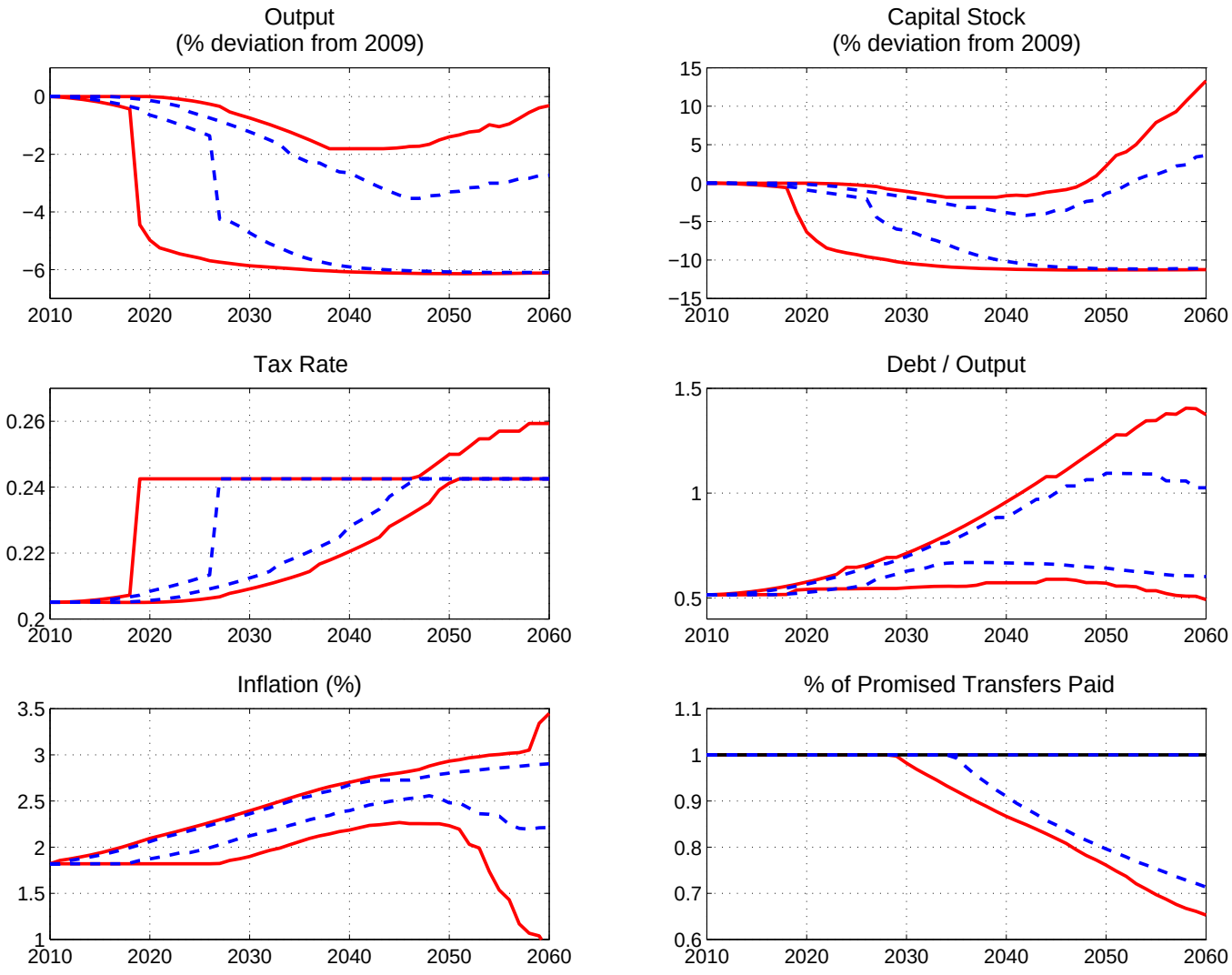


DEBT DYNAMICS

- Large jump in the price level at the fiscal limit generates stark differences in real debt levels

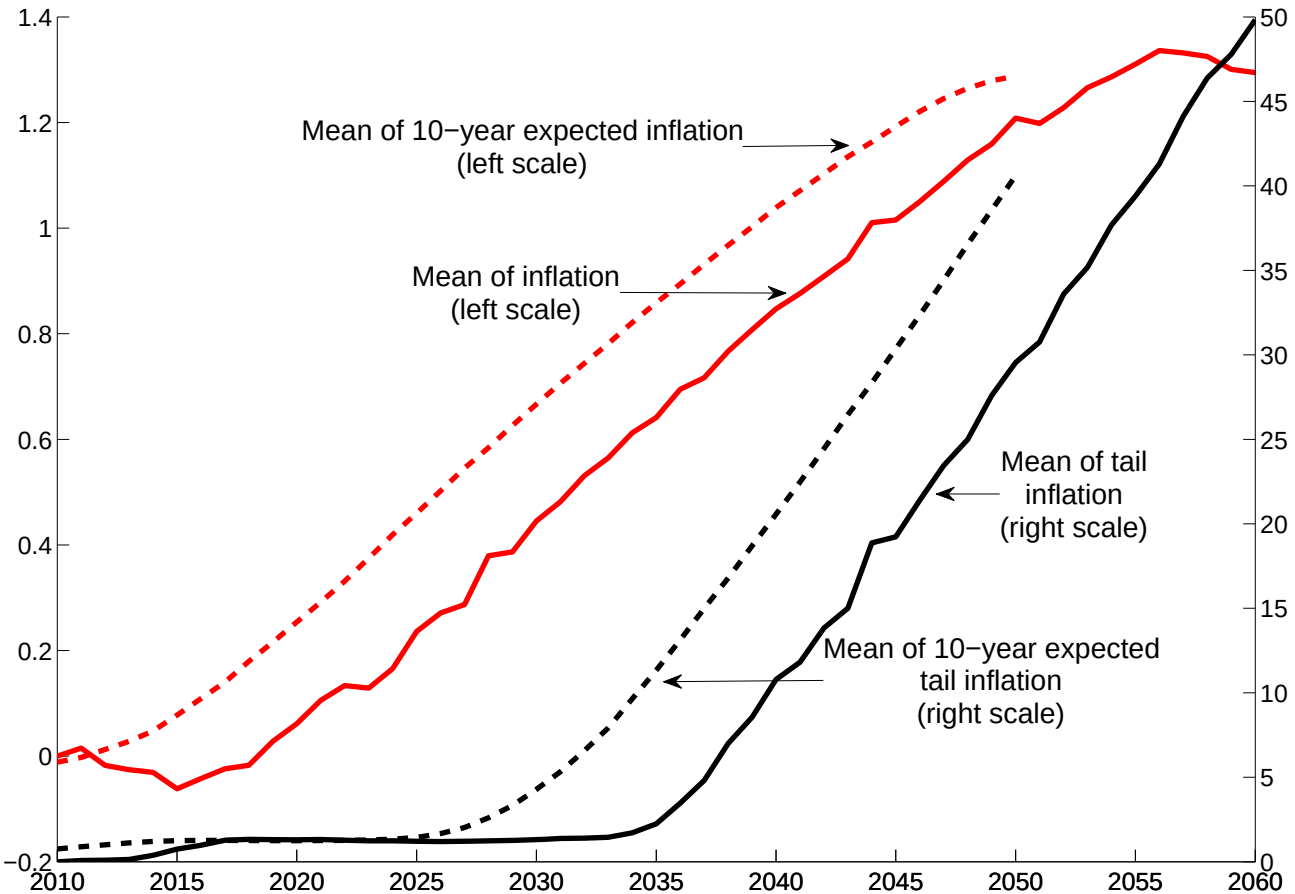


Wide Range of Possible Outcomes



Range of possible outcomes for macro variables due to uncertainty about future policy. Dashed blue lines are 25th and 75th percentile bands; solid red lines are 10th and 90th percentile bands.

Inflation Has a Fat Tail



Left scale: average paths of inflation (solid red line) and 10-year-ahead expected inflation (dashed red line); Right scale: average paths of inflation (solid black line) and 10-year-ahead expected inflation from 0.5 percent tail of distribution (dashed black line)

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