Finite Lifetimes, Long-term Debt and the Fiscal Limit

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STATE OF AWARENESS

- Unprecedented public discourse surrounding fiscal policy (debt limit discussions, Tea Party movement, political divide over public employees' collective bargaining rights, war/defense spending)
- Heightened concern about current deficits—record federal budget deficits (FY11: $1.65T, FY12: $1.1T) and large state budget deficits (FY11: 46, totaling $130B)
- Policymakers have begun to recognize that the *real* problem is prospective deficits (presidential commissions, bipartisan task forces, and proposals by elected officials aimed at curbing the growth rate of spending)

WHY FISCAL POLICY IS CHALLENGING

- Proposals offer potential resolutions, but ...
  - Congress does not provide a clear message about how policy will unfold
  - Even if Congress does act, new Congresses could always reverse policies
- Response: Agents are forced to condition on a broad set of policy outcomes
- Challenge: Simple accounting exercises that presume current policy will remain in effect are unequipped to assess the macroeconomic implications of unsustainable government budget deficits.

CONNECTION TO THE LITERATURE

- Approach 1:
  - 55-period OLG models: Include features such as inter- and intra-generational heterogeneity, life-cycle and population dynamics, bequest motives, stochastic income levels, and several program-specific components
  - Drawback: Unable to account for the degree of uncertainty that actually surrounds monetary and fiscal policies.
- Approach 2:
  - Representative agent models: Account for the uncertain nature of monetary and fiscal policy
  - Drawback: Unable to account for specific program features or distributional/generational effects

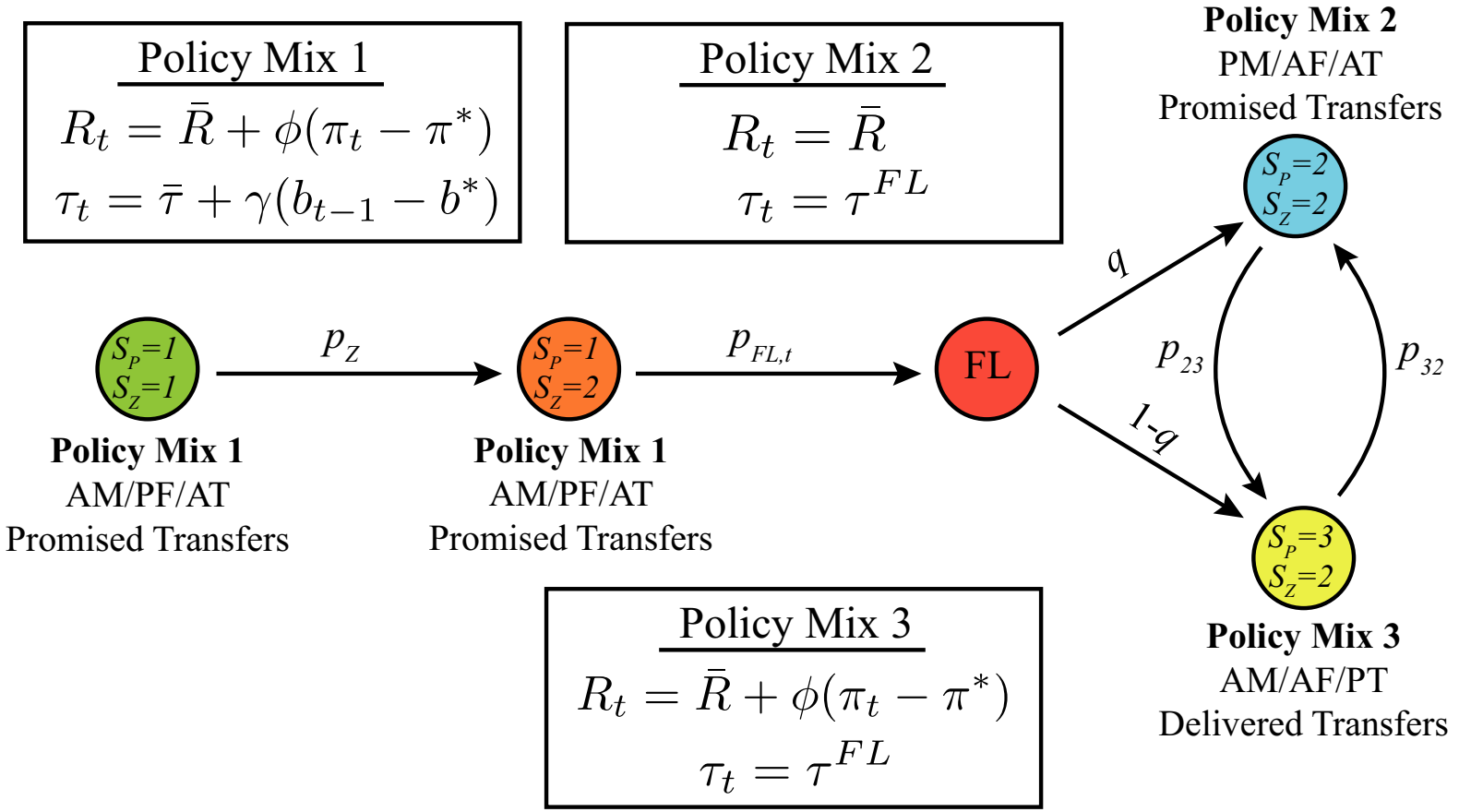
CONTRIBUTION

- This paper assesses the economic consequences of fiscal stress by accounting for
  - a fiscal limit—point where higher taxes are no longer feasible
  - several layers of monetary and fiscal policy uncertainty
  - intergenerational transfers of wealth
  - a debt maturity structure
  - a probability of reform
- Preview of the main findings:
  - Intergenerational transfers of wealth strengthen the effects of the fiscal limit and magnify the likelihood of stagflation
  - A longer average maturity of debt weakens the short and medium run effects of the fiscal limit—stagflation only poses a serious economic risk several decades into the future

MODEL FEATURES

- Discrete time variant of the Blanchard (1985)-Yaari (1965) Perpetual Youth model
  - Agents are subject to identical probabilities of death, ϑ
  - Admits aggregation and supports a realistic period length
  - Links policy uncertainty and intergenerational transfers of financial wealth
- Economic Framework
  - Endogenous labor supply and choice of money holdings
  - Goods are supplied under monopolistic competition
  - Firms face costly (Rotemberg) price adjustments
  - Proportional tax on capital and labor income
  - Maturity structure for government debt

POLICY EVOLUTION



PROBABILITY OF FISCAL LIMIT

- Endogenous probability of hitting the fiscal limit follows

$$p_{FL,t} = 1 - \frac{\exp(\eta_0 - \eta_1(\tau_{t-1} - \bar{\tau}))}{1 + \exp(\eta_0 - \eta_1(\tau_{t-1} - \bar{\tau})}),$$

  where η_0 and $\eta_1 > 0$ pin down the intercept and slope of the logistic function

- Captures some of the uncertainty that surrounds government spending programs when they are funded by future revenue streams, such as with pay-as-you-go financing

GENERATION-SPECIFIC PROBLEM

- Agents from generation $s \leq t$ maximize

$$E_t \sum_{k=t}^{\infty} [\beta(1-\vartheta)]^{t-k} \left(\log c_{s,k} + \kappa \log(m_{s,k}/P_k) + \chi \log(1-n_{s,k})\right)$$

- Two types of government debt
  - One-period bonds in zero net supply
  - Longer-term bonds in non-zero net supply

- Longer-term bond has price P_t^M and the properties
  - Pays ρ^j dollars $j+1$ periods in the future, for $0 \leq \rho \leq \beta^{-1}$
  - Average maturity: $1/(1-\beta\rho)$

- Per-period budget constraint

$$c_{s,t} + k_{s,t} + \frac{m_{s,t}}{P_t} + \frac{P_t^S b_{s,t}^S}{P_t} + \frac{P_t^M b_{s,t}^M}{P_t} \leq \omega_{s,t} + (1-\vartheta)^{-1} a_{s,t}$$

- Human income

$$\omega_{s,t} \equiv (1-\tau_{s,t}) w_{s,t} n_{s,t} + \lambda_t z_{s,t} + d_{s,t},$$

- Beginning of the period financial wealth

$$a_{s,t} \equiv [(1-\tau_{s,t}) R_t^k + 1 - \delta] k_{s,t-1} + \frac{m_{s,t-1}}{P_t} + \frac{b_{s,t-1}^S}{P_t} + \frac{(1+\rho P_t^M) b_{s,t-1}^M}{P_t}$$

LAW OF MOTION FOR CONSUMPTION

- Aggregate Values

$$X_t \equiv \sum_{s=-\infty}^{t} \vartheta(1-\vartheta)^{t-s} x_{s,t}$$

- Aggregate law of motion for consumption

$$C_t = \frac{1}{\beta} E_t\{Q_{t,t+1} C_{t+1}\} + \frac{1}{\beta} \frac{\vartheta\xi}{1-\vartheta} E_t\{Q_{t,t+1} A_{t+1}\}$$

where $\xi \equiv [1-\beta(1-\vartheta)]/(1+\kappa)$

  - When $\vartheta = 0$, the model reduces to the traditional RA model
  - When $\vartheta \neq 0$, an increase in government liabilities increases current consumption
  - Breaks down Ricardian Equivalence—Timing of taxes matters!

ANALYTICAL MODEL SETUP

- Cashless Perpetual Youth Model
- Log utility
- Inelastically supplied labor
- Constant endowment
- Debt maturity structure
- Lump-sum taxes
- Log-linear approximation

EQUILIBRIUM

- Law of motion for consumption

$$\hat{R}_t = E_t\hat{\pi}_{t+1} + \mu(\hat{P}_t^M + \hat{b}_t^M)$$

- Government budget constraint

$$\hat{\pi}_t = \hat{b}_{t-1}^M + \rho P^S \hat{P}_t^M - \bar{Q}\left[\hat{P}_t^M + \hat{b}_t^M + \tilde{\tau}\hat{\tau}_t - \tilde{Z}\hat{Z}_t\right]$$

- Term structure of interest rates

$$\hat{P}_t^M = \hat{P}_t^S + \rho\bar{P}^S E_t\hat{P}_{t+1}^M = -\sum_{j=0}^{\infty}(\rho P^S)^j E_t\hat{R}_{t+j}$$

- Monetary and fiscal policy rules

$$\hat{R}_t = \phi\hat{\pi}_t \quad \text{and} \quad \hat{\tau}_t = \gamma(\hat{P}_{t-1}^M + \hat{b}_{t-1}^M)$$

ACTIVE MONETARY/PASSIVE FISCAL POLICY

- Unique bounded solution for inflation:

$$\hat{\pi}_t = \frac{\mu}{\phi} \sum_{k=0}^{\infty} \left(\frac{1}{\phi} \right)^k (E_t \hat{P}^M_{t+k} + E_t \hat{b}^M_{t+k})$$

- Implications:
  - RA: MA consistently meets its inflation target ($\hat{\pi}_t = 0$)
  - PYM: As debt rises, agents feel wealthier and require higher interest rates to save. With a Taylor rule, this implies higher inflation.
  - Result: FA influences inflation dynamics even when it is aggressively targeted.
  - MA could adjust $\hat{R}_t$ with fluctuations in government debt
  - Longer term debt dilutes the FA interference

- Intertemporal equilibrium condition (IEC):

$$\hat{b}_{t-1}^{M} + \rho \bar{P}^{S} \hat{P}_{t}^{M} - \hat{\pi}_{t} = \bar{Q} \sum_{k=0}^{\infty} \tilde{\beta}^{k} E_{t} \left[\tilde{\tau} \hat{\tau}_{t+k} - \tilde{Z} \hat{Z}_{t+k} \right]$$

- Implications:
  - Transfers shocks propagate through bond prices, inflation, and current/future taxes
  - RA: MA meets its inflation target, and any debt financed increase in transfers is met by a commensurate increase in the discounted present value of taxes.
  - PYM: Wealth effects cause inflation to temporarily rise above target. Disturbances to transfers are partially financed by an increase in inflation.
  - The maturity structure of debt determines the timing of inflation

PASSIVE MONETARY/ACTIVE FISCAL POLICY

- Suppose $\hat{\tau}_t = 0$ and the MA weakly responds to inflation
- When fiscal policy is exogenous, the IEC reduces to

$$\hat{P}_t - \rho \bar{P}^S \hat{P}_t^M = \hat{B}_{t-1}^M + \bar{Q} \sum_{k=0}^{\infty} \tilde{\beta}^k E_t \tilde{Z} \hat{Z}_{t+k}$$

- FA determines the overall *change* in prices: Higher transfers increase consumption demand and drive up prices (either P_t or future prices via P_t^M)
- The MA determines the overall *timing* of price changes: MA can focus on stabilizing either P_t or P_t^M.
  Example: If MA pegs the nominal interest rate, P_t adjusts and inflation is brought into the present

FISCAL LIMIT MODEL

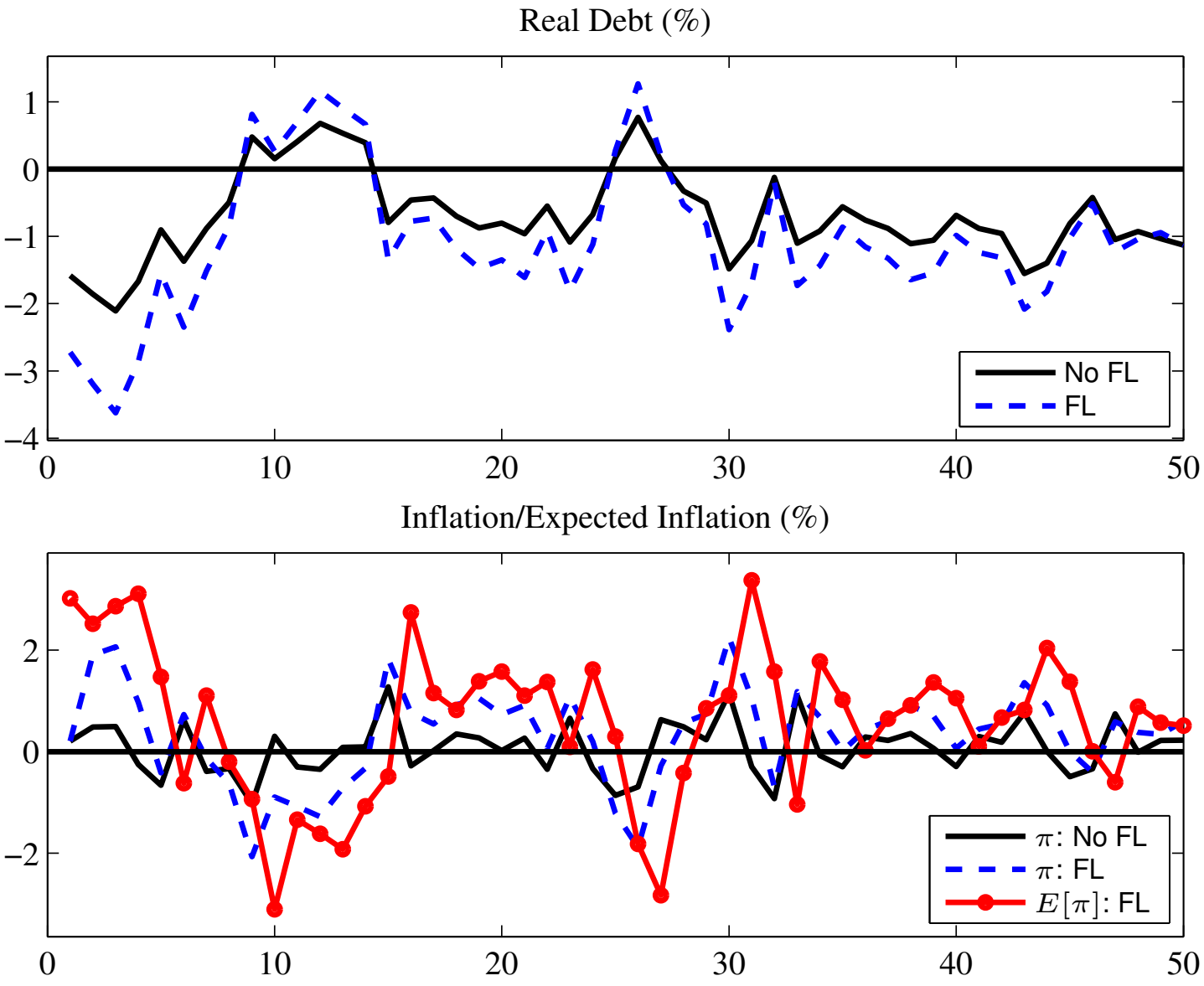
	Before the Fiscal Limit Binds $t = 0, 1, \ldots, T-1$	After the Fiscal Limit Binds $t = T, T+1, \ldots$
Tax Policy	$\hat{\tau}_t = \gamma(\hat{P}^M_{t-1} + \hat{b}^M_{t-1})$	$\hat{\tau}_t = 0$
Monetary Policy	$\hat{R}_t = \phi\hat{\pi}_t$	$\hat{R}_t = 0$

- Equilibrium value of debt

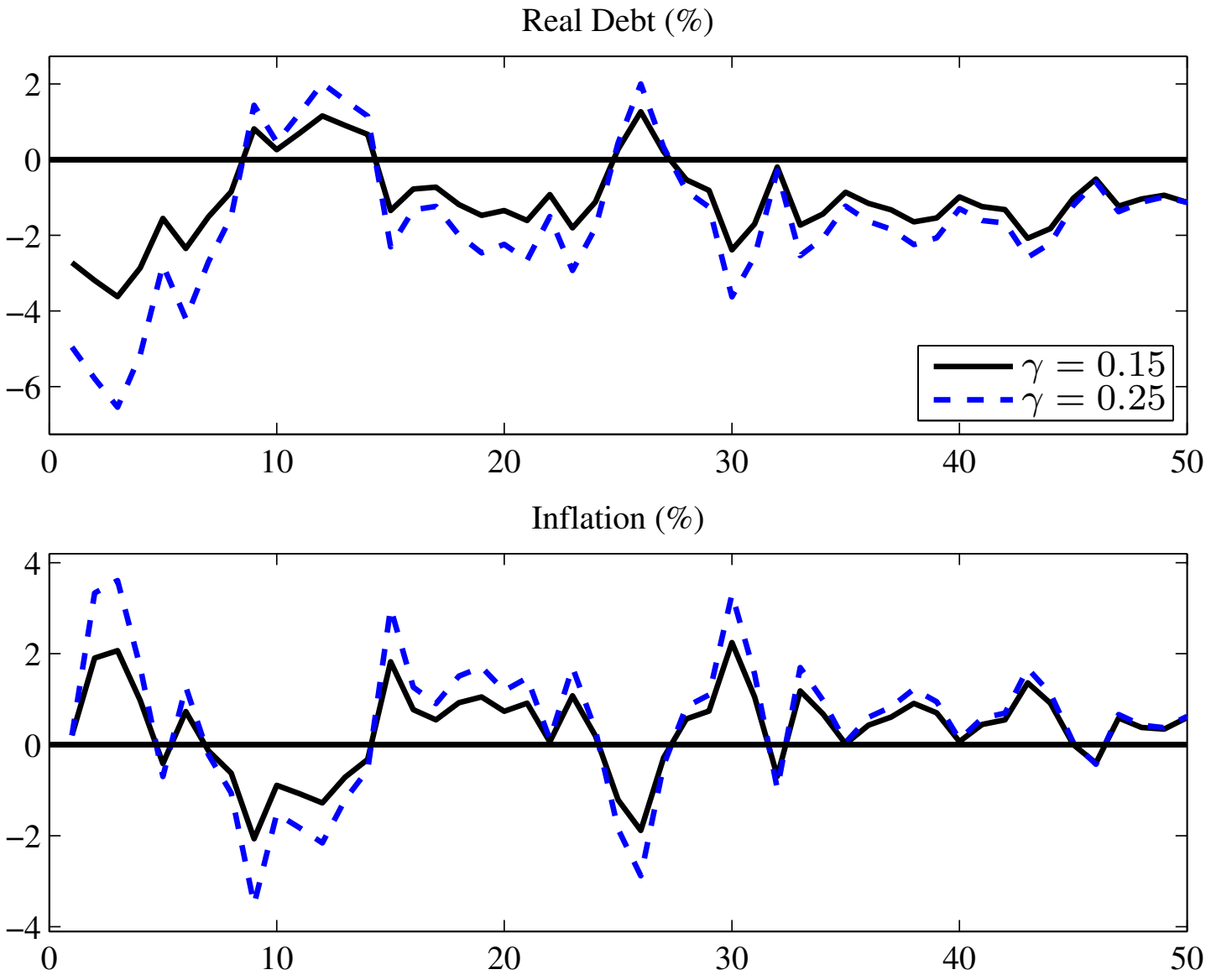
$$\hat{P}^M_t + \hat{b}^M_t = \begin{cases} -\left[\left(\frac{1}{1-\gamma\tilde{\beta}\tilde{\tau}}\right)^{T-t-1} \frac{(\tilde{\beta}\rho^S_Z)^{T-t}}{1-\tilde{\beta}\rho^S_Z} + \sum_{k=1}^{T-t-1}\left(\frac{\tilde{\beta}\rho^S_Z}{1-\gamma\tilde{\beta}\tilde{\tau}}\right)^k\right]\tilde{Z}\hat{Z}_t, & \text{for } t < T, \\ -\frac{\tilde{\beta}\rho^S_Z}{1-\tilde{\beta}\rho^S_Z}\tilde{Z}\hat{Z}_t, & \text{for } t \geq T. \end{cases}$$

- Fiscal limit breaks down Ricardian equivalence
- Higher transfers reduce the market value of debt
- Higher γ and ϑ increase the volatility of debt

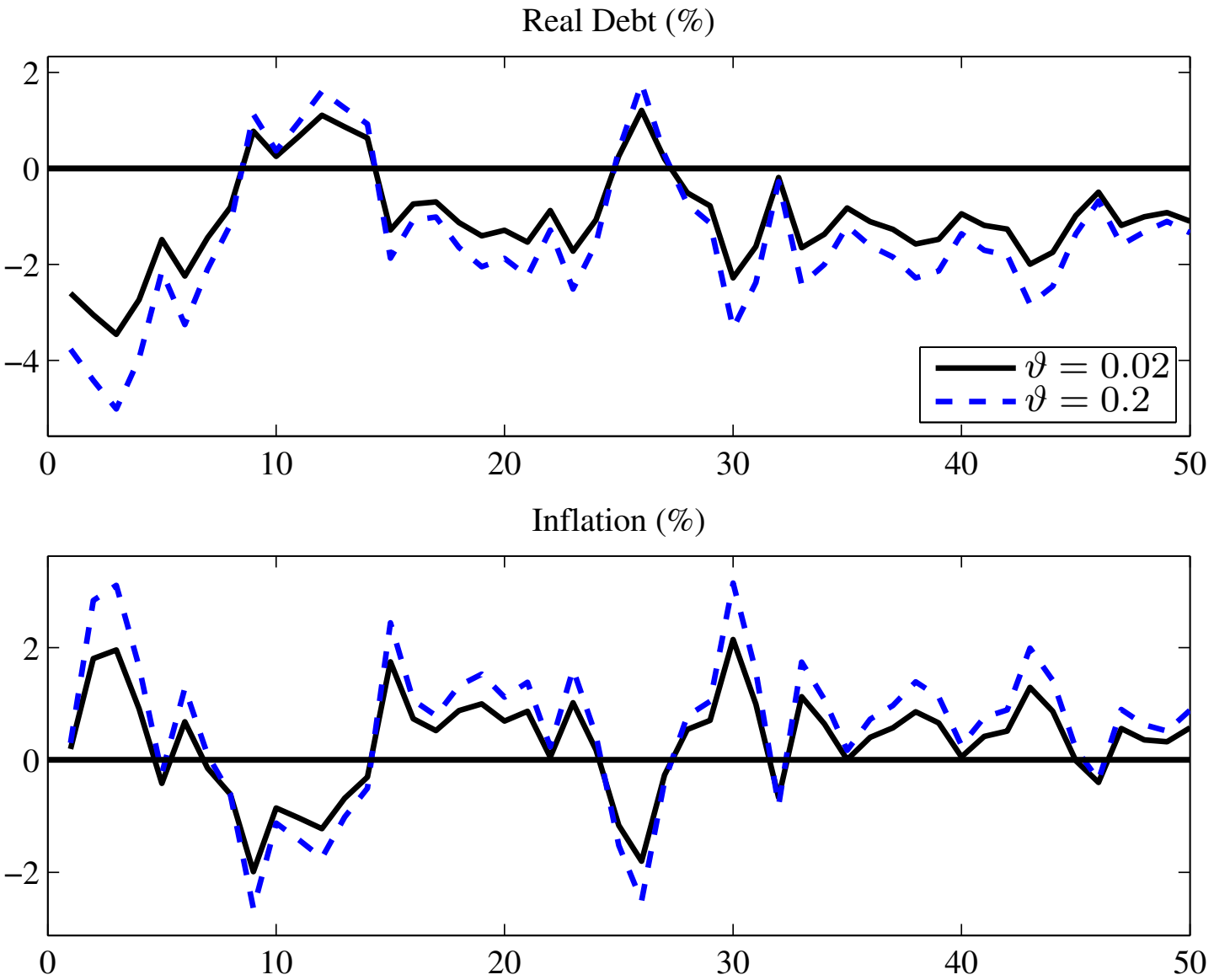
FISCAL LIMIT EFFECT



RESPONSE OF TAXES TO DEBT



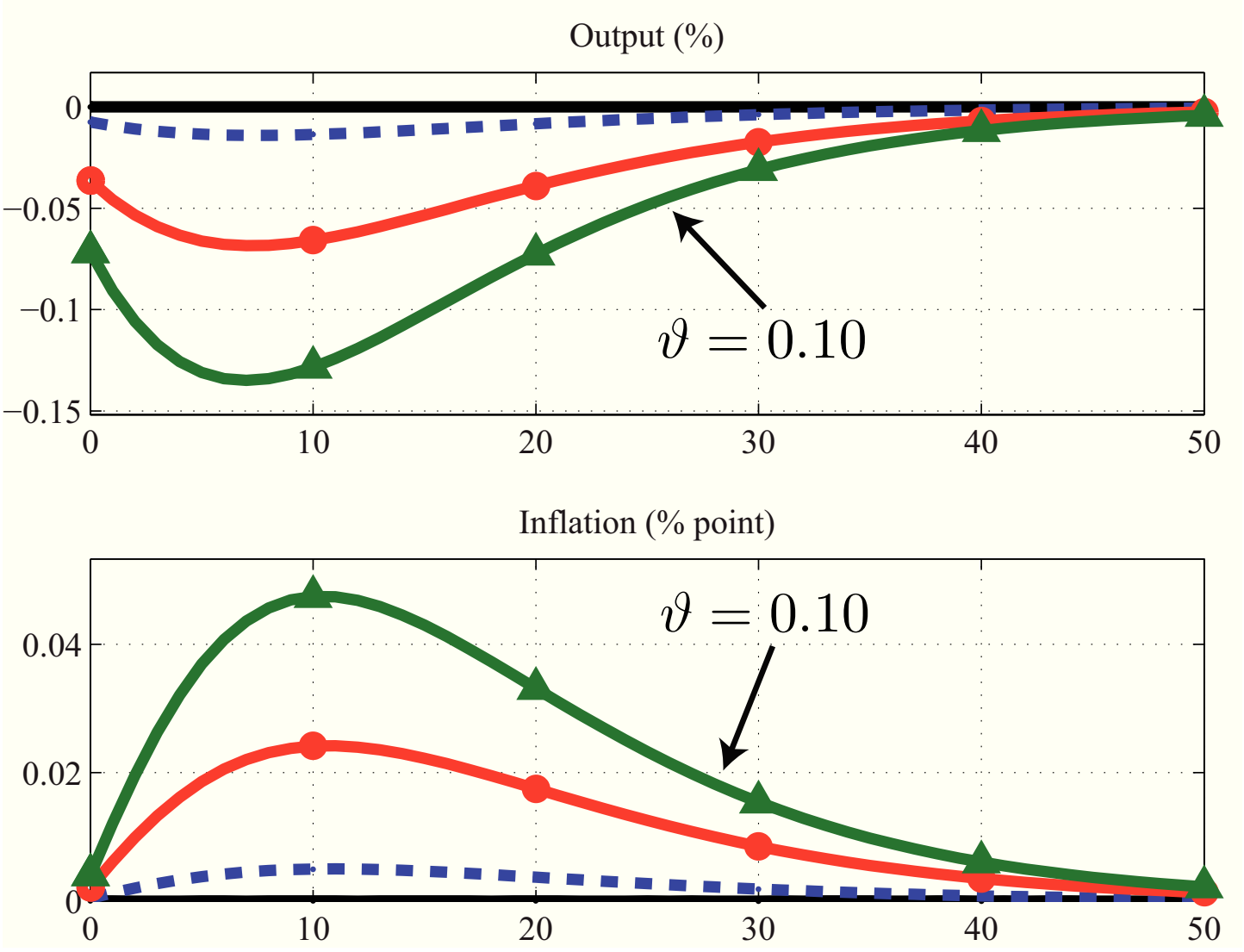
PROBABILITY OF DEATH



No Fiscal Limit

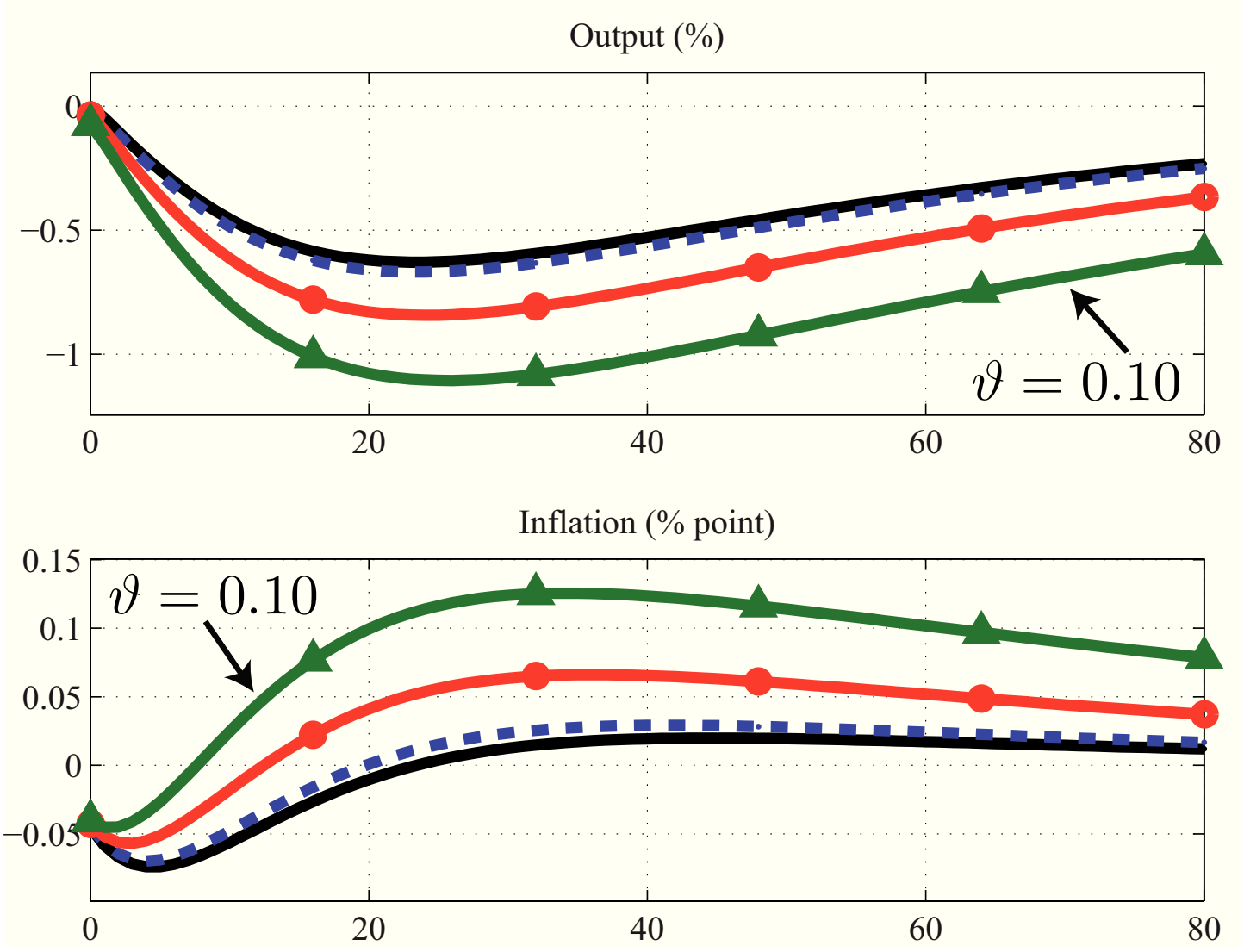
Policy Mix 1

LUMP SUM TAXES, TRANSFERS SHOCK



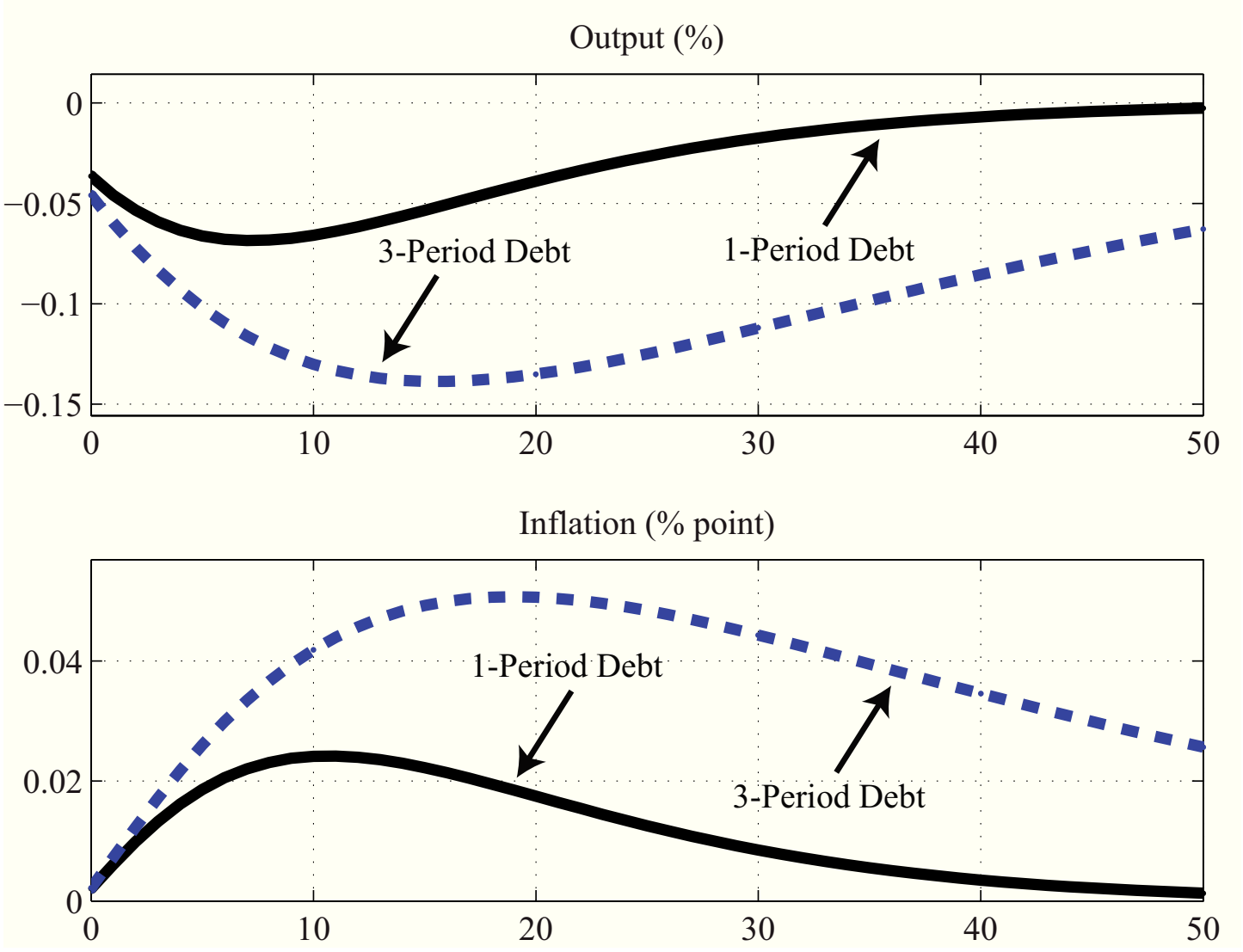
- RA: Bears the entire burden of future taxes and fully discounts any shocks to government transfers—Ricardian Equivalence holds!
- PYM: Possibility that agents will die before taxes come due
  - Positive transfers shock redistributes wealth from future to current generations
  - Increases consumption, reduces labor supply, and crowds out private savings
  - Rising marginal costs produce inflation
  - Reduces real government liabilities and leads to negative wealth effects
  - Results in stagflation

DISTORTIONARY TAXES, TRANSFERS SHOCK



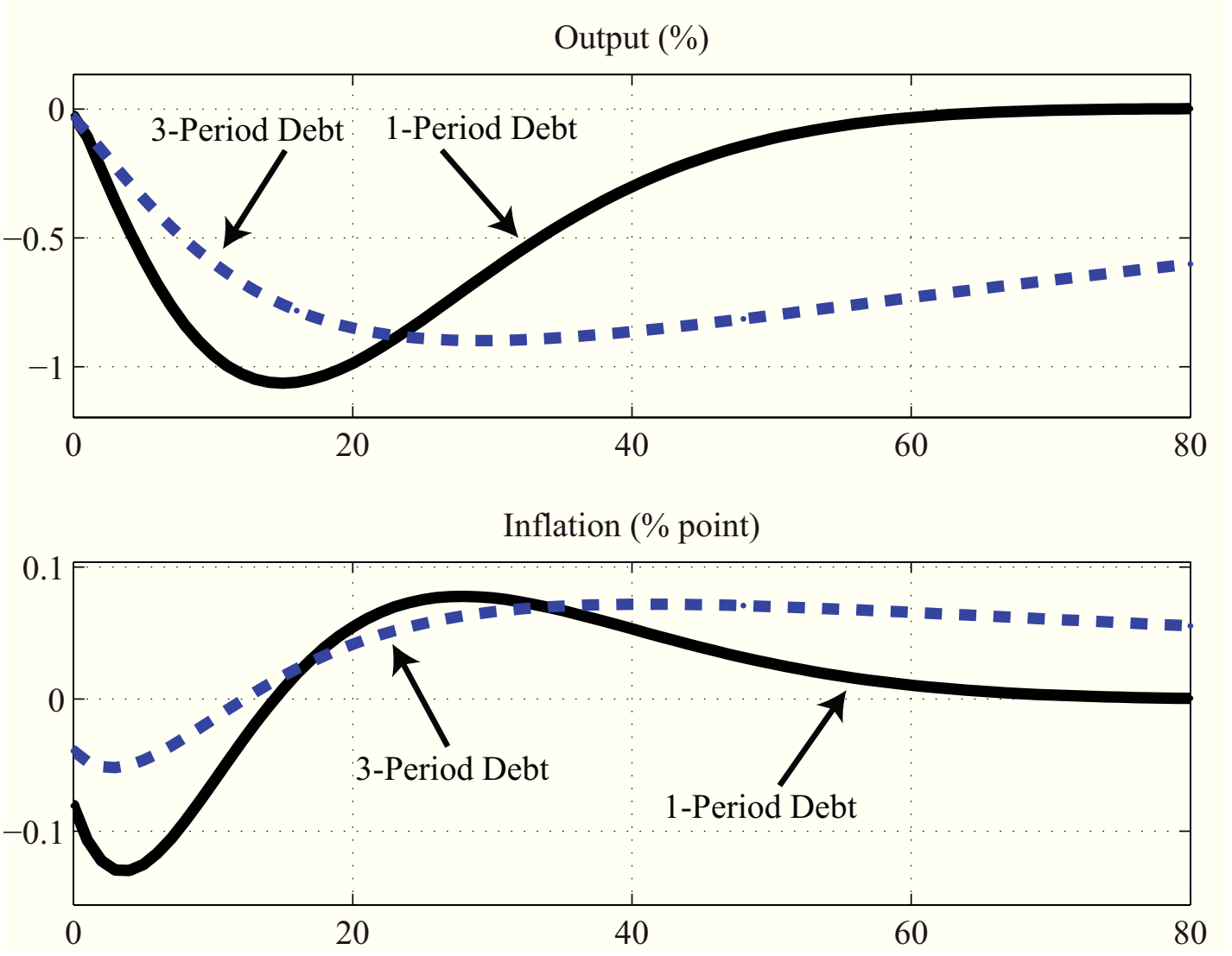
- Impact of proportional taxes levied against capital and labor income:
  - Reduces incentives to work and invest—Breaks Ricardian Equivalence (regardless of ϑ)
  - Higher marginal costs lead to higher inflation
  - Produces larger negative wealth effects when agents are finitely lived
  - Stronger feedback effects between inflation and AS
  - Leads to more severe and more persistent stagflation

LUMP SUM TAXES, LONGER-TERM DEBT



- RA: Ricardian Equivalence continues to hold—Timing of taxes does not matter!
- PYM: Longer-term debt delays the impact from transfers shocks
  - Longer average maturity of government debt pushes the financing of government liabilities into the future
  - Increases the tax burden for future generations and magnifies wealth effects
  - Greater AD and less AS induces higher inflation
  - Falling bond prices and higher inflation lead to larger negative wealth effects
  - Less volatile debt, but more severe and more persistent stagflation

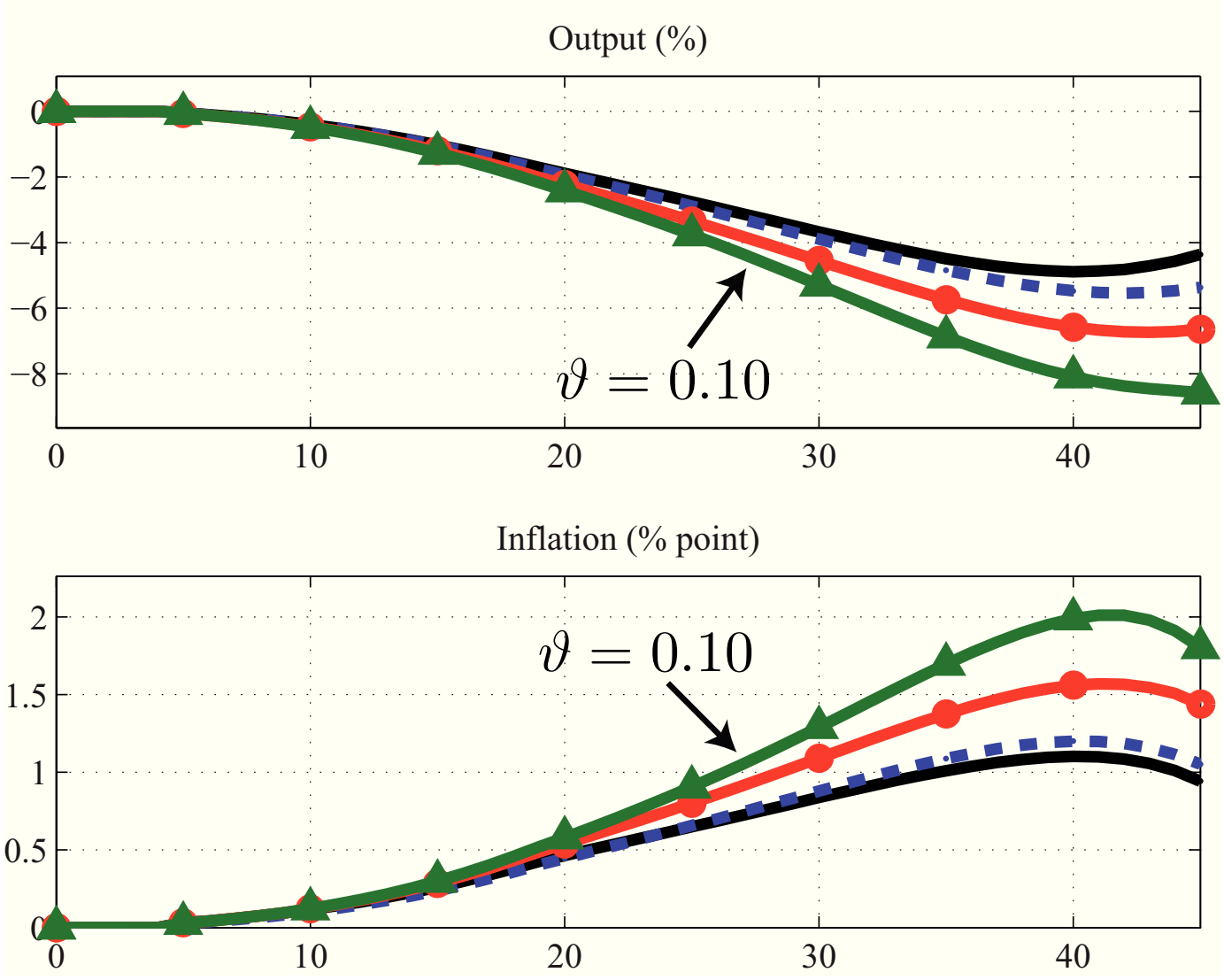
DISTORTIONARY TAXES, LONGER-TERM DEBT



- Impact of proportional taxes levied against capital and labor income:
  - Delayed tax increases now imply greater incentives to work and invest
  - Reduces the sharp decrease in AS and contributes to a more modest increase in inflation
  - Eventually taxes come due and the distortionary effects produce larger reductions in AS in the long-run
  - Longer average maturity of government debt reduces macroeconomic volatility, but at the steep cost of protracted stagflation

Fiscal Limit Model

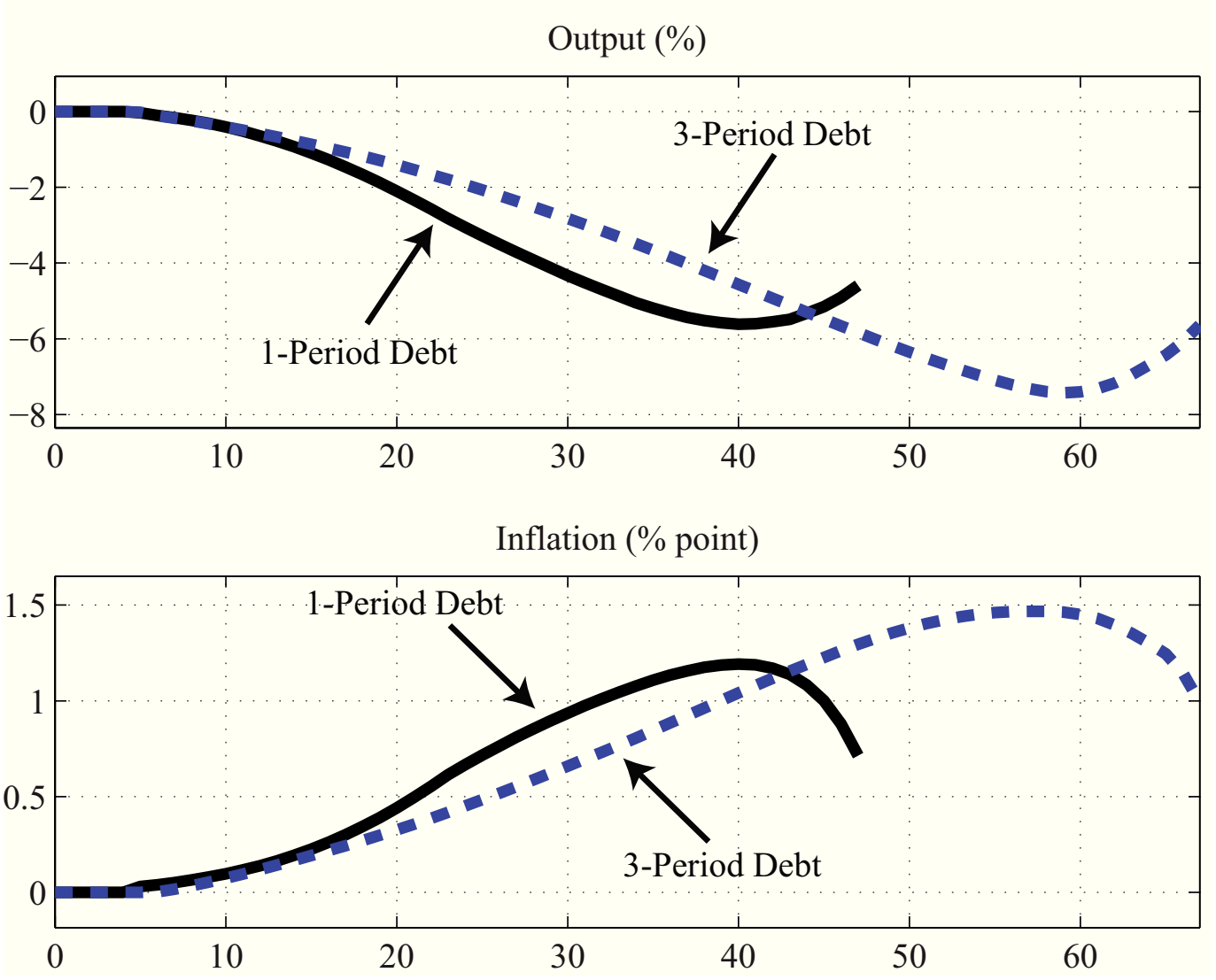
GROWING TRANSFERS, POLICY MIX 1



- Experiment: Economy begins in “normal times” (stable transfers, policy mix 1)
- In period 5, policy mix 1 continues to hold, but transfers switch to a non-stationary process
- Figure displays counterfactual transition paths: what if policy never adjusts?
  - Growing transfers push real debt and taxes higher
  - Lower incentives to work and invest decreases AS/AD
  - Prospect of debt revaluation increases inflation
  - When $\tau > \tau^{FL}$, expectation of lower taxes and reneging
  - Increases AS and lowers inflation
  - Result: Fiscal stress induces stagflation

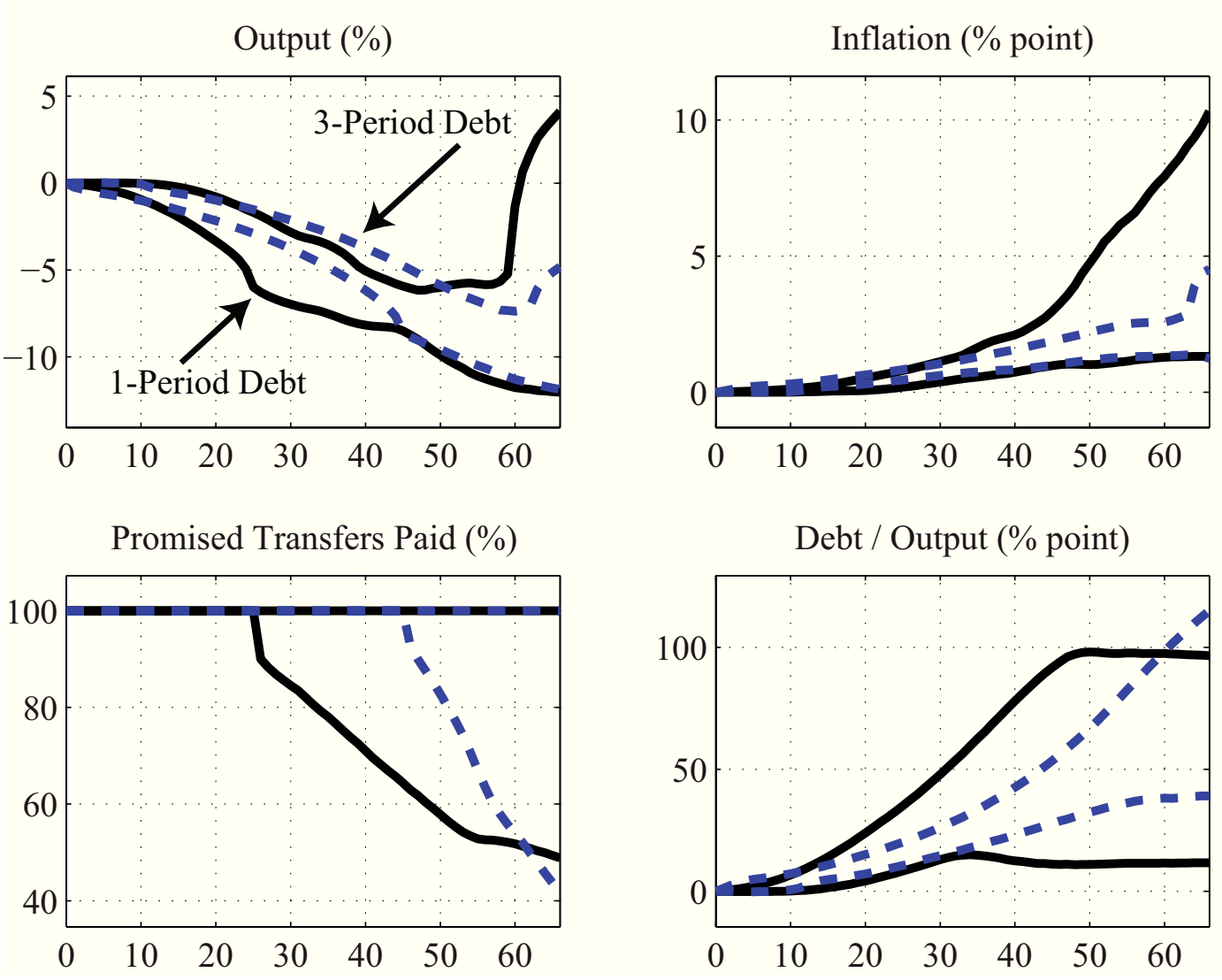
- Effect of intergenerational transfers of wealth
  - Steadily rising inflation reduces real wealth
  - Causes further reductions in AS and additional inflation
  - Post fiscal limit effects become operative at a later date
- Result
  - FL makes fighting inflation more difficult for the MA
  - Severity and duration of the stagflationary period increases with the probability of death
  - When the planning horizon is shortened to 10 years, the loss in output and increase in inflation double

GROWING TRANSFERS, POLICY MIX 1



- Expectational effects of the FL are pushed into the future
  - Changes to the yield curve serve as a shock absorber
  - Growing transfers are met with a decline in the price of the long-term bond
  - Increases the slope of the yield curve and pushes the financing of government liabilities into the future
  - Result: Short/medium-run effects of fiscal stress are reduced
- Eventual decreases in AS are more contractionary
  - FA is able to respond to taxes for a longer period
  - Further erodes incentives to work and invest

MONTE CARLO SIMULATIONS

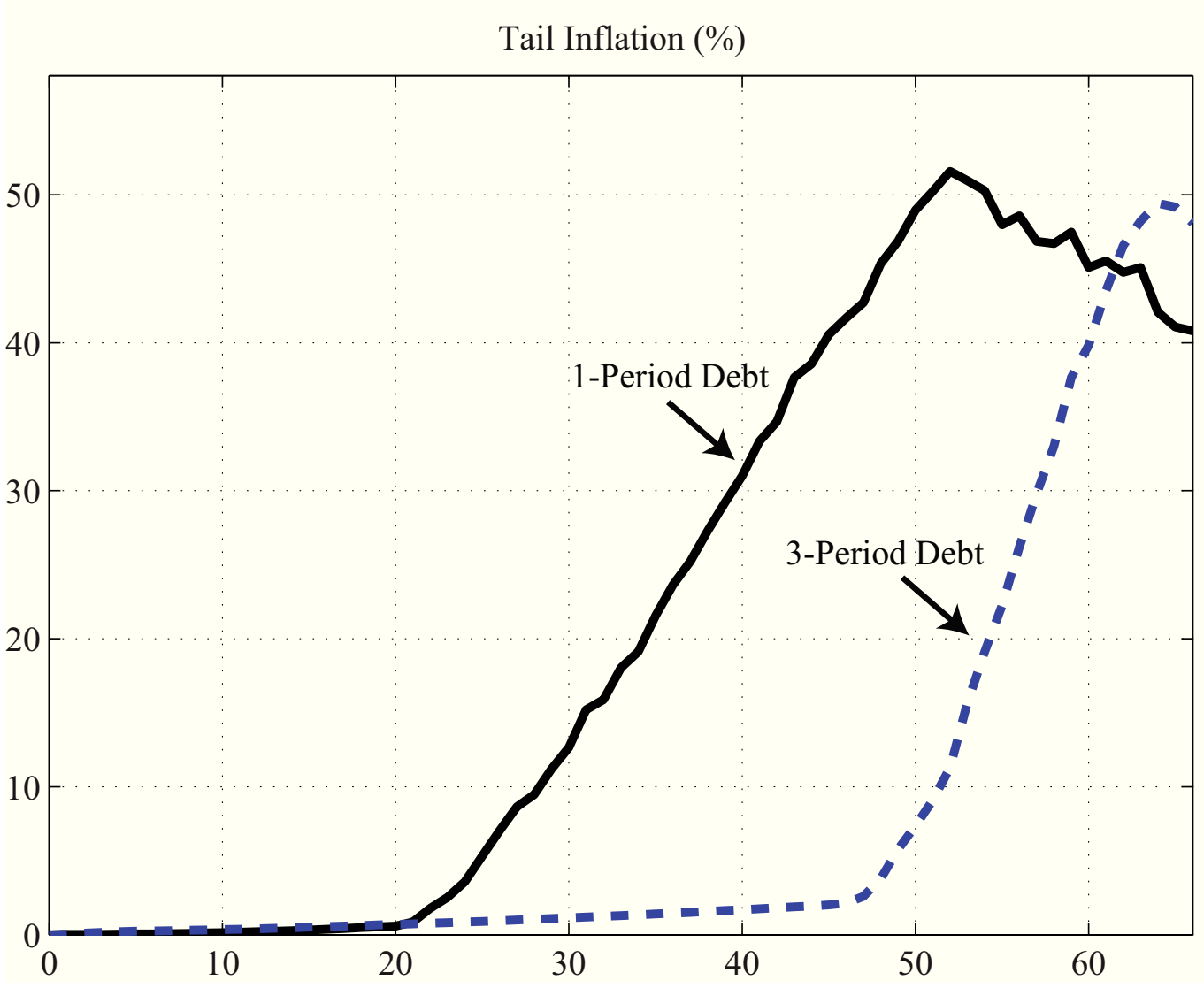


SUMMARY

- Short-term debt
  - Fiscal limit consistently hit 45 years into the future
  - Flattens the trajectory of debt
  - Inflation mounts, but is restrained by the prospect of reneging (precautionary savings motive)
- Longer-term debt
  - Reductions in real variables occur 15 years later
  - 90th percentile: inflation never exceeds 3% and debt remains below WWII levels 50 years into the future
  - Further evidence: conditional tail expectation of inflation

$$E[\pi_t | \pi_t > \pi^{\mathcal{T}}] = \frac{1}{N \cdot \mathcal{T}} \sum_{n=1}^{N} \pi_t^{(n)} \mathcal{I}_{[\mathcal{T},\infty)}$$

TAIL INFLATION (99.5 PERCENTILE)

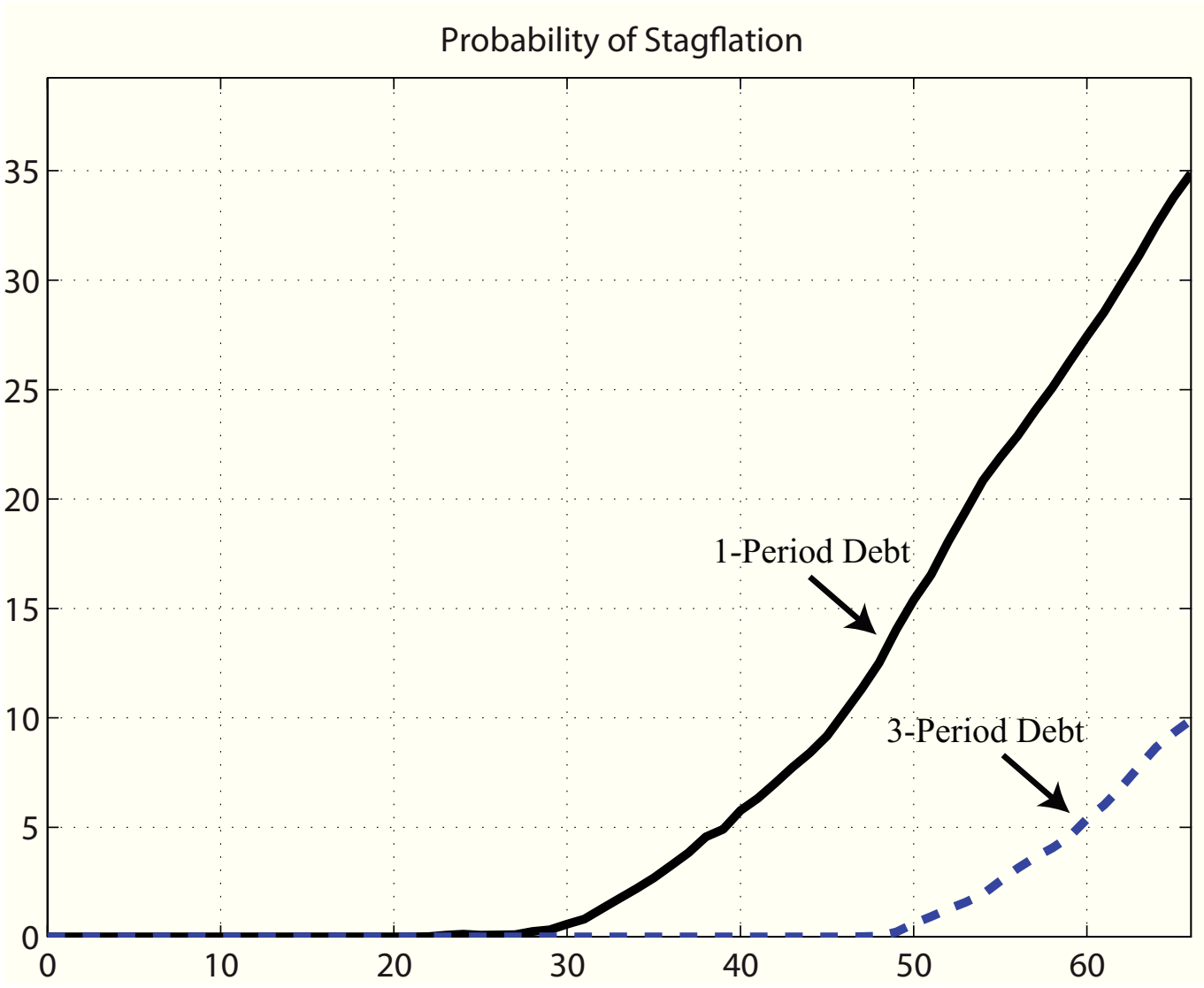


- Effect of a longer average maturity of debt:
  - Tail outcomes of inflation increase 30 years later
  - Reduces the risk of inflation and virtually eliminates the prospect of hyperinflation for the next 50 years
  - When the probability of the FL rises, tail inflation rises
  - Tail inflation peaks as more reneging regimes are realized
- Monte Carlo simulations can be misleading because they report percentiles across all simulations, instead of the characteristics of each simulation
- Probability of stagflation:

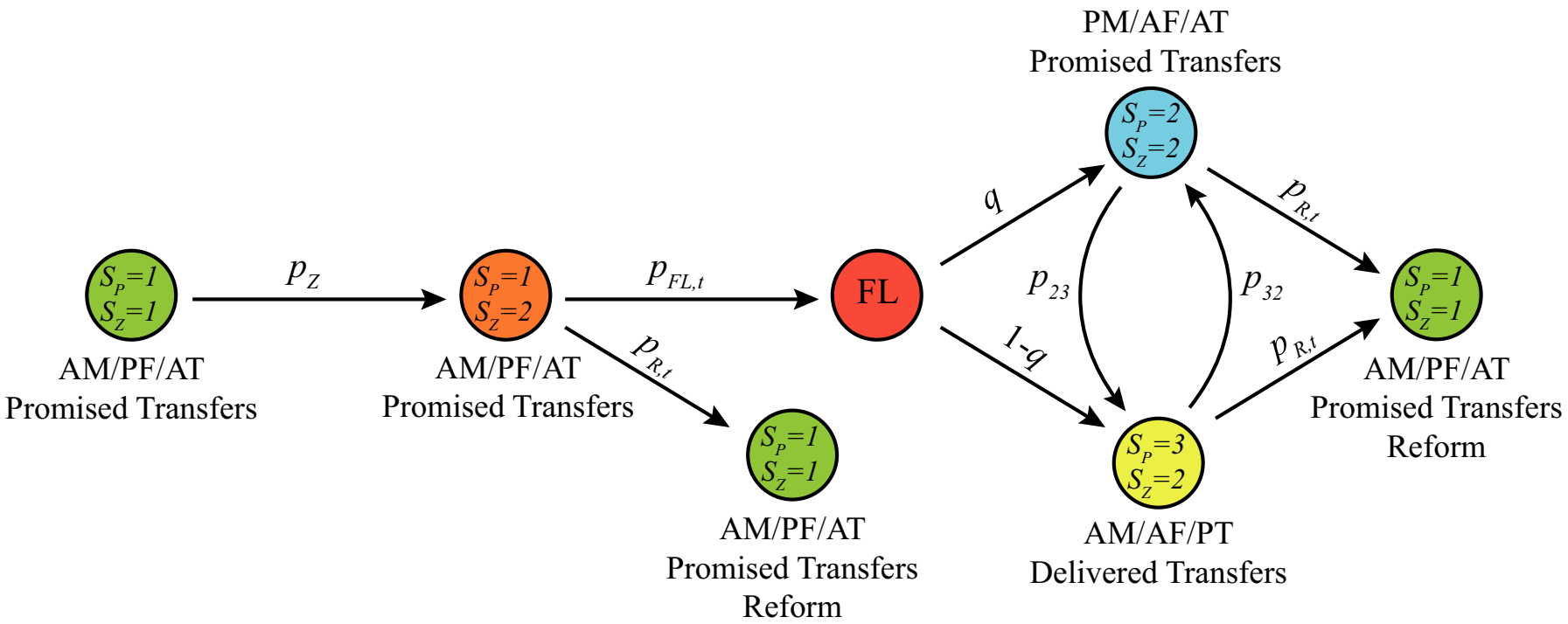
$$\Pr[\%\Delta Y < 1\% \ \ \& \ \ \pi > 4\%]$$

confirms earlier findings

PROBABILITY OF STAGFLATION



NEW POLICY EVOLUTION



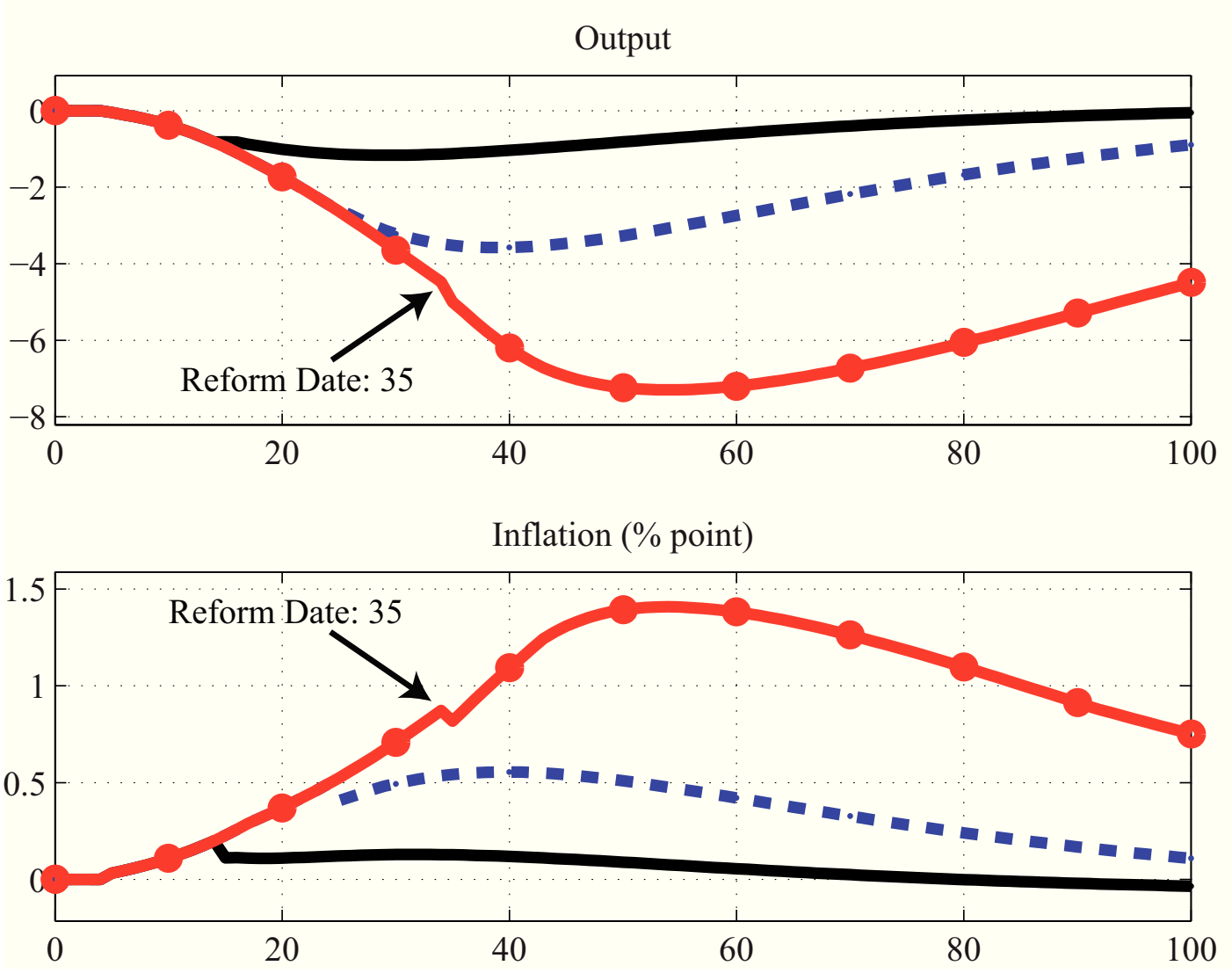
PROBABILITY OF REFORM

- Reform places transfers back on a stable trajectory (move from $S_Z = 2$ to $S_Z = 1$)
- Probability of reform is endogenously determined by

$$p_{R,t} = 1 - \frac{\exp(\eta_0^R - \eta_1^R(b_{t-1}^M - (b^M)^*))}{1 + \exp(\eta_0^R - \eta_1^R(b_{t-1}^M - (b^M)^*))},$$

- Captures the political discontent associated with higher debt levels

REFORM DATE


Output
0
−2
−4
−6
−8
Reform Date: 35
0
20
40
60
80
100
Inflation (% point)
1.5
1
0.5
0
Reform Date: 35
0
20
40
60
80
100

EFFECT OF DELAYING REFORM

- Accumulated debt service obligations and a persistently high probability of hitting the fiscal limit continues to drive up the debt and inflation even after the date of reform
- The number of years it takes the economy to rebound from a period of growing transfers increases exponentially with the number of years it takes to pass reform

WHAT THIS PAPER DOES

1. Takes a stand on how policy will unfold
2. Takes seriously the reality that there exists a fiscal limit—political or economic—to the revenues that can be generated from taxes.
3. Accounts for key intergenerational redistributions of wealth
4. Accounts for alternative debt maturity structures
5. Introduces a probability of reform

KEY FINDINGS

1. The dire scenarios the CBO project never transpire, but stagflation and some degree of reneging are likely
2. Intergenerational transfers of wealth strengthen the effects of the fiscal limit and magnify the likelihood of stagflation
3. The presence of long-term debt reduces the short/medium run impacts of the fiscal limit. For the next fifty years, tail inflation poses only mild risk
4. RA model produces immediate inflation, which is inconsistent with current inflation expectations. Many economists contend that heightened fiscal uncertainty implies looming inflation. Longer-term debt reconciles these points
5. Delaying reform exponentially increases the duration of the stagflationary period