Monetary and Fiscal Policy Interactions: Leeper (1991) Redux

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Highlights of the paper

- We study a model of monetary-fiscal policy interaction where *both monetary and fiscal policy can switch* between states

- Extension of Leeper (1991) to Markov Switching and of Davig and Leeper (2007) to fiscal policy

- We use the method developed by Foerster, Rubio Ramirez, Waggoner and Zha (2014) to study determinacy and to find all possible solutions

Findings

- The Long-Run Taylor Principle (LRTP) in Davig and Leeper (2007) depends on the stance of fiscal policy

- Fiscal Policy Frontier (FPF) and Monetary Policy Frontier (MPF), rather than LRTP

- *When both monetary and fiscal policy are switching many possible cases arise and the neatness of Leeper (1991) disappears*

- Implications for the IRF and expectation effects → dynamics: consistent with the literature

  - no expectation wealth effects if MP *sufficiently active* and FP *sufficiently passive*

  - In a PM/AF regime, agents should believe that the policy mix will be *sufficiently* "Ricardian" in the other regime to control inflation

→ our contribution is to identify what "*sufficiently*" means through our determinacy analysis and the use of FPF and MPF

Motivations and research questions: Leeper (1991) redux

- Leeper (1991): *equilibria under "active" and "passive" monetary and fiscal policies*

	AM	PM
AF	explosiveness	determinacy non-Ricardian case (FTPL)
PF	determinacy Ricardian case	indeterminacy

- DL (2007): determinacy analysis under Markov switching, but only under passive fiscal policy. Main insights are:

  - **cross-regime spillovers**: the economy equilibrium properties are "contaminated" both by the characteristics of the other regimes and by the probability of shifting towards these alternative regimes

  - **Long-Run Taylor Principle** (LRTP): determinacy is possible "even while deviating from [the Taylor principle] substantially for brief periods or modestly for prolonged periods" → determinacy region is larger than in the constant-parameter setup

- Therefore, our paper addresses the following research questions:

  1. *allow for shifts in fiscal policy* → what role for fiscal policy in equilibrium determinacy in a MS version of Leeper (1991)?

  2. analysing monetary-fiscal policy interaction and expectations spillovers effects across regimes

Model and methodology

- We consider a simple NK model with monetary and fiscal policy

$$1 = \beta E_t \left(\frac{Y_t - G_t}{Y_{t+1} - G_{t+1}} \frac{R_t}{\Pi_{t+1}} \right),$$

$$(1-\alpha)^{\frac{1}{\theta-1}} \frac{\theta-1}{\theta} \phi_t \left(1 - \alpha \Pi_t^{\theta-1}\right)^{\frac{1}{1-\theta}}$$

$$= \mu Y_t + \alpha (1-\alpha)^{\frac{1}{\theta-1}} \beta \frac{\theta-1}{\theta} E_t \left[\phi_{t+1} \Pi_{t+1}^{\theta} \left(1 - \alpha \Pi_{t+1}^{\theta-1}\right)^{\frac{1}{1-\theta}} \right],$$

$$\phi_t = \frac{Y_t}{Y_t - G_t} + \alpha \beta E_t (\phi_{t+1} \Pi_{t+1}^{\theta-1}),$$

$$b_t = R_t \left(\frac{b_{t-1}}{\Pi_t} + G_t - \tau_t \right), \qquad \text{with} \quad b_t = R_t \frac{B_t}{P_t},$$

and the following policy rules

$$R_t = R_{SS} \left(\frac{\Pi_t}{\bar{\Pi}} \right)^{\gamma_{\pi,t}} e^{\varepsilon_{m,t}},$$

$$G_t = G_{SS}^{1-\rho_g} G_{t-1}^{\rho_g} e^{\varepsilon_{g,t}},$$

$$\tau_t = \tau_{SS} \left(\frac{b_{t-1}}{b_{SS}} \right)^{\gamma_{\tau,t}} e^{\varepsilon_{\tau,t}}.$$

Active and passive policies

- We use the same notation as in Leeper (1991):

- Monetary policy is active (AM) if $\gamma_{\pi} > 1$

- Fiscal policy is passive (PF) if $\gamma_{\tau} \in \left[(1-\beta) \frac{b_{SS}}{\tau_{SS}}, (1+\beta) \frac{b_{SS}}{\tau_{SS}} \right] = [0.0196, 3.902]$

Solution method

- We use the perturbation method by Foerster, Rubio Ramirez, Waggoner and Zha (2014). This method extends Schmitt-Grohe and Uribe (2004) to the MS framework.

  ✓ direct perturbation of the original nonlinear model with MS parameters → other methods linearize the fixed coefficient model and then add MS dynamics

  ✓ Groebner basis approach to tackle the quadratic polynomial equations that yield the solution: *all solutions can be found* → other methods rely on numerical algorithms that generally find a subset of solutions (if they find any)

Stability of the solutions

- First-order approximate solutions are assessed using the mean square stability criterion suggested by Farmer, Waggoner and Zha (2009)

- The determinacy region corresponds to all those parameterizations where a single, mean square stable solution exists

  - when multiple stable solutions exist → indeterminacy

  - when no stable solution exists → explosiveness

Results: determinacy analysis

### Always PF: the LRTP of Davig and Leeper (2007) applies
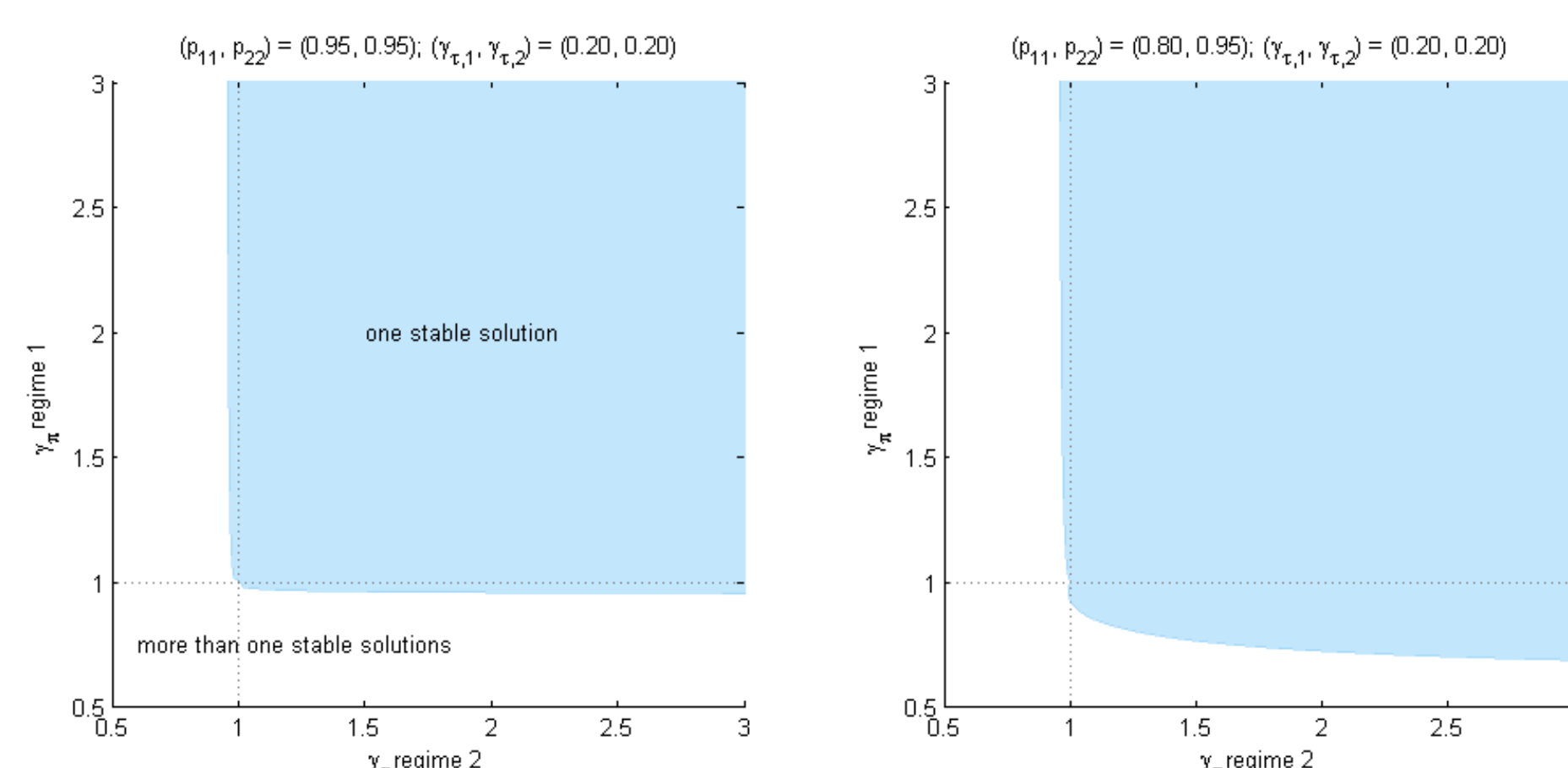
- monetary policy allowed to be temporarily *passive* (indeterminate equilibrium for fixed coefficients) if *sufficiently* active in the other regime

- asymmetric mean duration expands the determinacy region in favor of the more transient regime

Always AF: extending Davig and Leeper (2007)
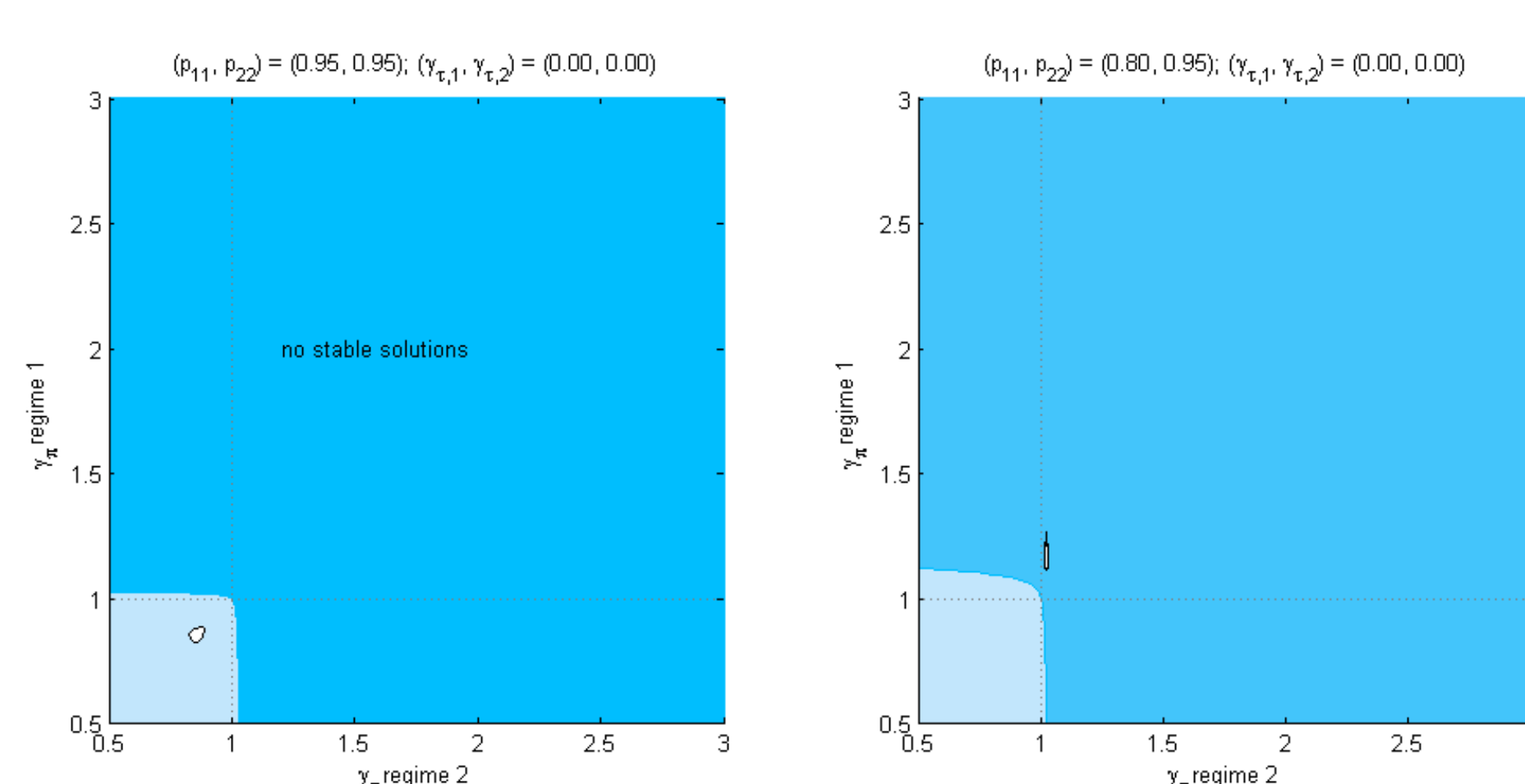
- Generalization of the LRTP to an active fiscal policy:

  - monetary policy allowed to be temporarily *active* (explosive equilibrium for fixed coefficients) if *sufficiently passive* in the other regime

  - asymmetric mean duration results are confirmed

- Monetary Policy Frontier (MPF) that defines determinacy and as in Leeper (1991) depends on the fiscal policy stand

- Intuition, mixing Leeper (1991) and Davig and Leeper (2007):

  - if PF, MP should be *sufficiently active on average* between the two regimes

  - if AF, MP should be *sufficiently passive on average* between the two regimes
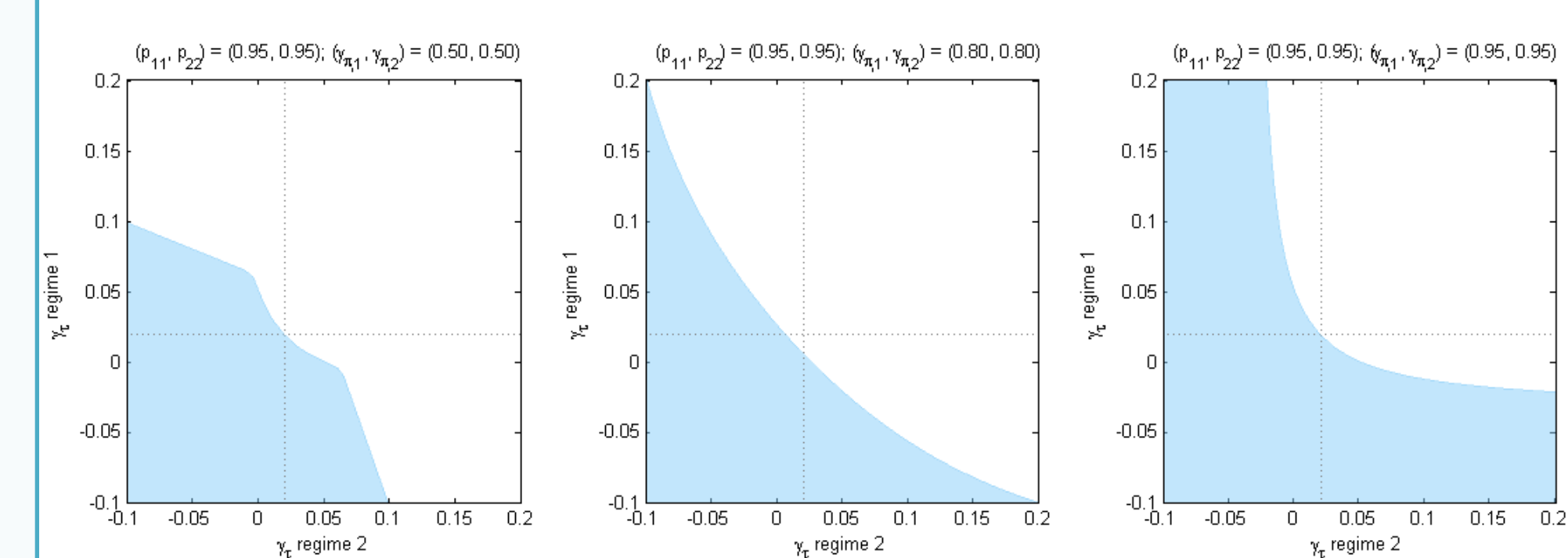
Switching fiscal policy
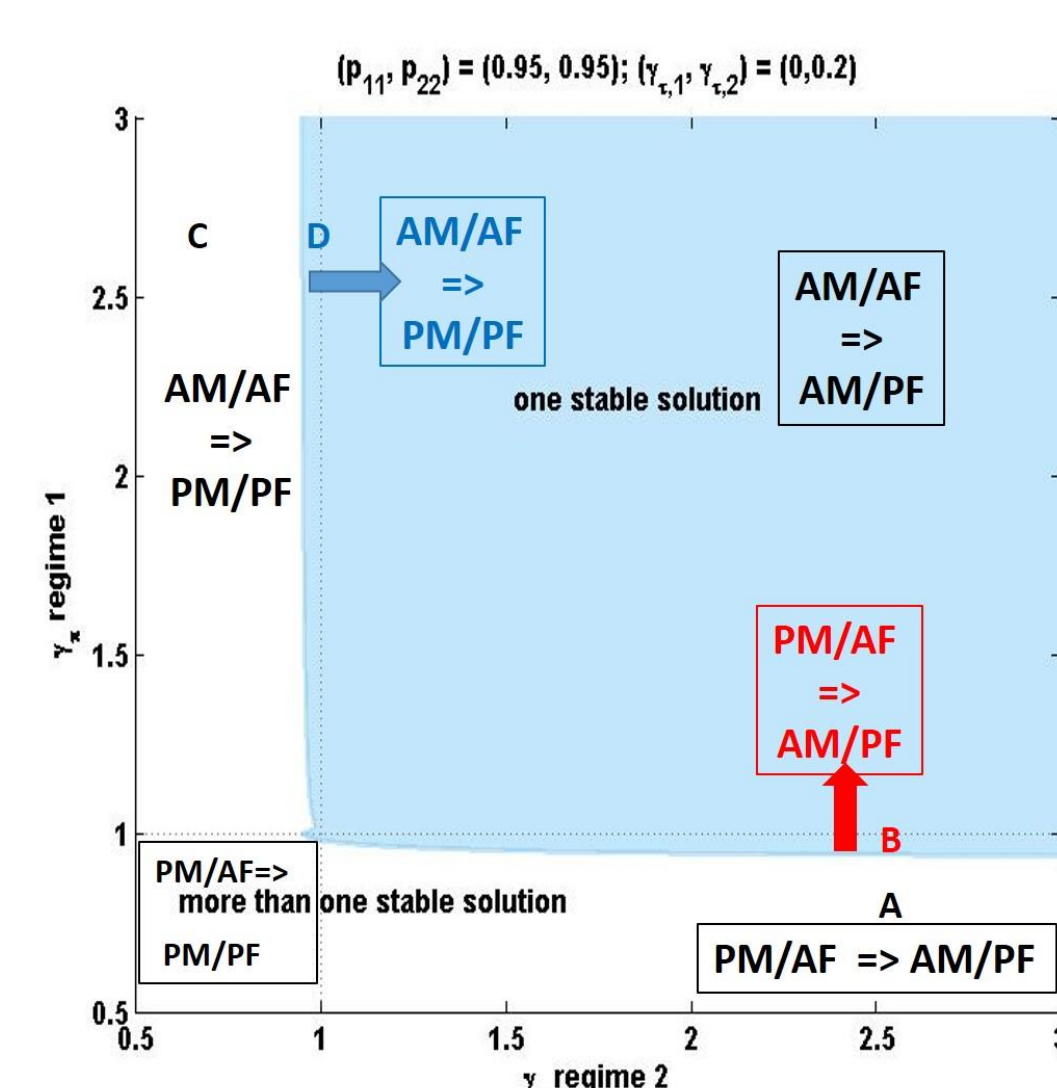
- What happens to determinacy if we allow for shifts from AF to PF?

  - everything can happen → the clear-cut results of Leeper (1991) are lost

  - MS b/w two determinate regimes can trigger indeterminacy (point A)

  - double active to double passive can return determinacy (point D)
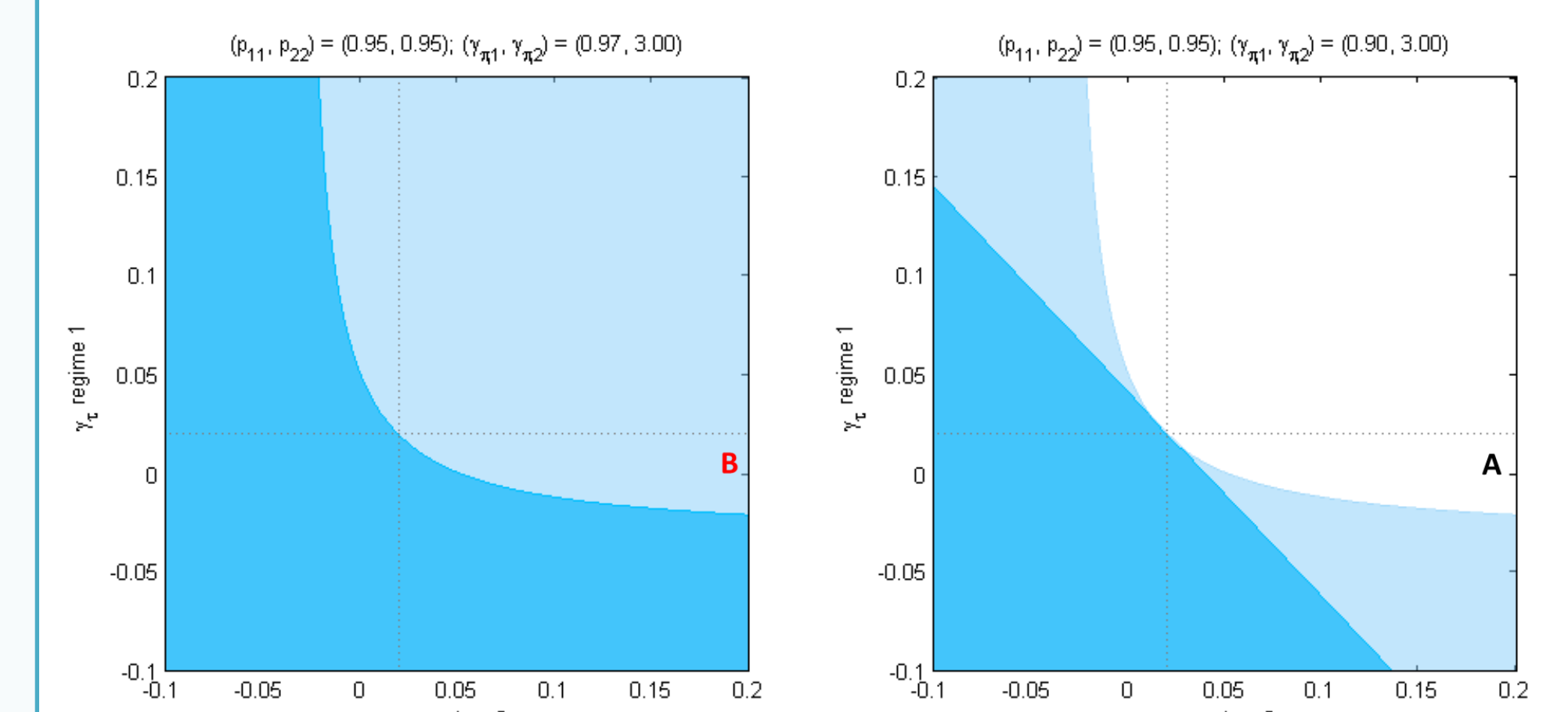
The Fiscal Policy Frontier: case always AM
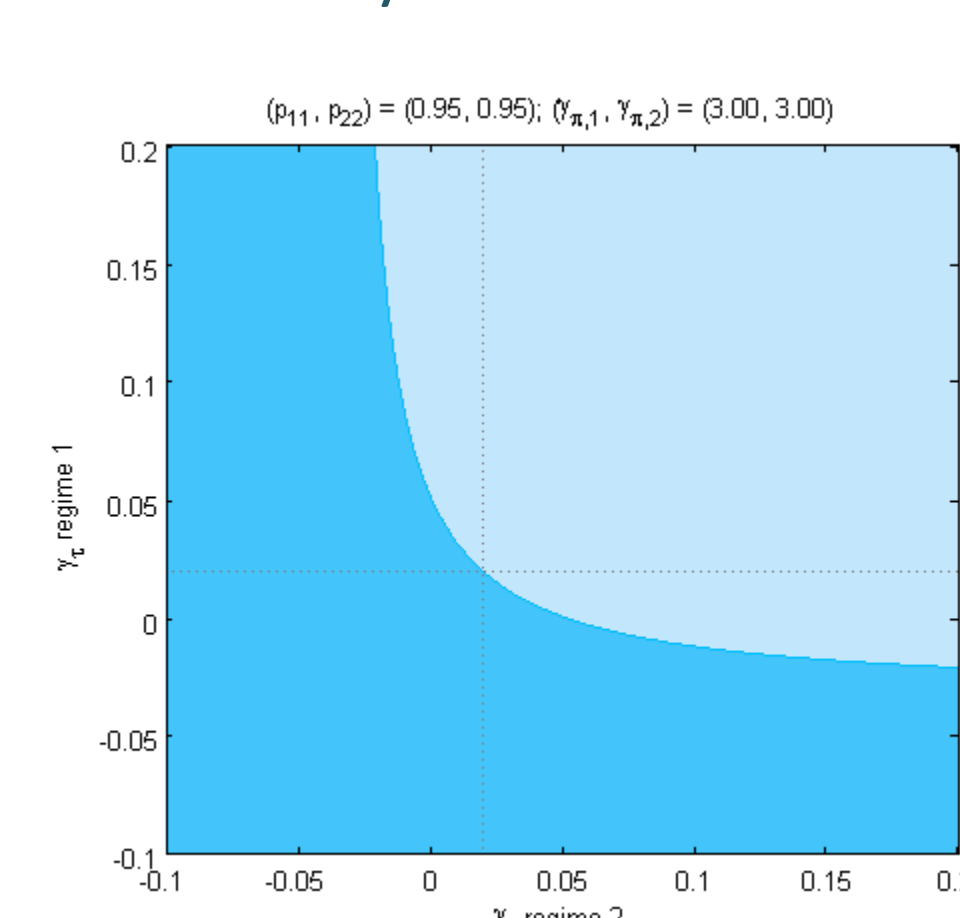
- Same intuition of the LRTP: temporary active fiscal is consistent with determinacy

- ...but not too much: determinacy requires to satisfy the FPF which is again a hyperbole

The Fiscal Policy Frontier: case always PM

The Fiscal Policy Frontier: switching monetary policy



- Left panel: $\gamma_{\pi,i} > p_{ii}$, for $i = 1,2$ → monetary policy is above the MPF

  - same frontier as in the case of always AM

- Right panel: $\gamma_{\pi,1} < p_{11}$ → MP is below the MPF but *on average* active

  - determinacy requirement: fiscal policy must switch among regimes and must be *on average* passive

- relation between the MPF and the FPF:

  - if MP is always passive → determinacy to the left of the FPF (i.e., FP sufficiently active *on average*)

  - If MP is above the MPF → determinacy to the right of the FPF (i.e., FP sufficiently passive *on average*)

  - If MP is below the MPF but on average active → determinacy with FP below the FPF, but *on average* passive (above the line that discriminates between average active or passive fiscal policy)

  - note that for the MPF, it matters only the FPF → **if FP on the right of the FPF then MP should be on the right of the MPF and vice-versa**

  - recall that the frontiers are conditional on the given "other" policy

Expectation effects

- Chung et al. (2007): *the existence of a non-Ricardian regime is sufficient to generate wealth effects, through expectation channel.* Therefore, the FTPL is always at work if agents attach a positive probability of moving towards active FP

→ we find this is not true if MP to the right of the MPF and fiscal policy to the right of FPF

- Liu et al. (2009) find asymmetric expectations effects => This is true even considering fiscal policy FP

→ we find this is true even considering fiscal policy

Response to a tax shock: MS vs fixed coefficients model

PM/AF   AM/PF   PM/AF   AM/PF
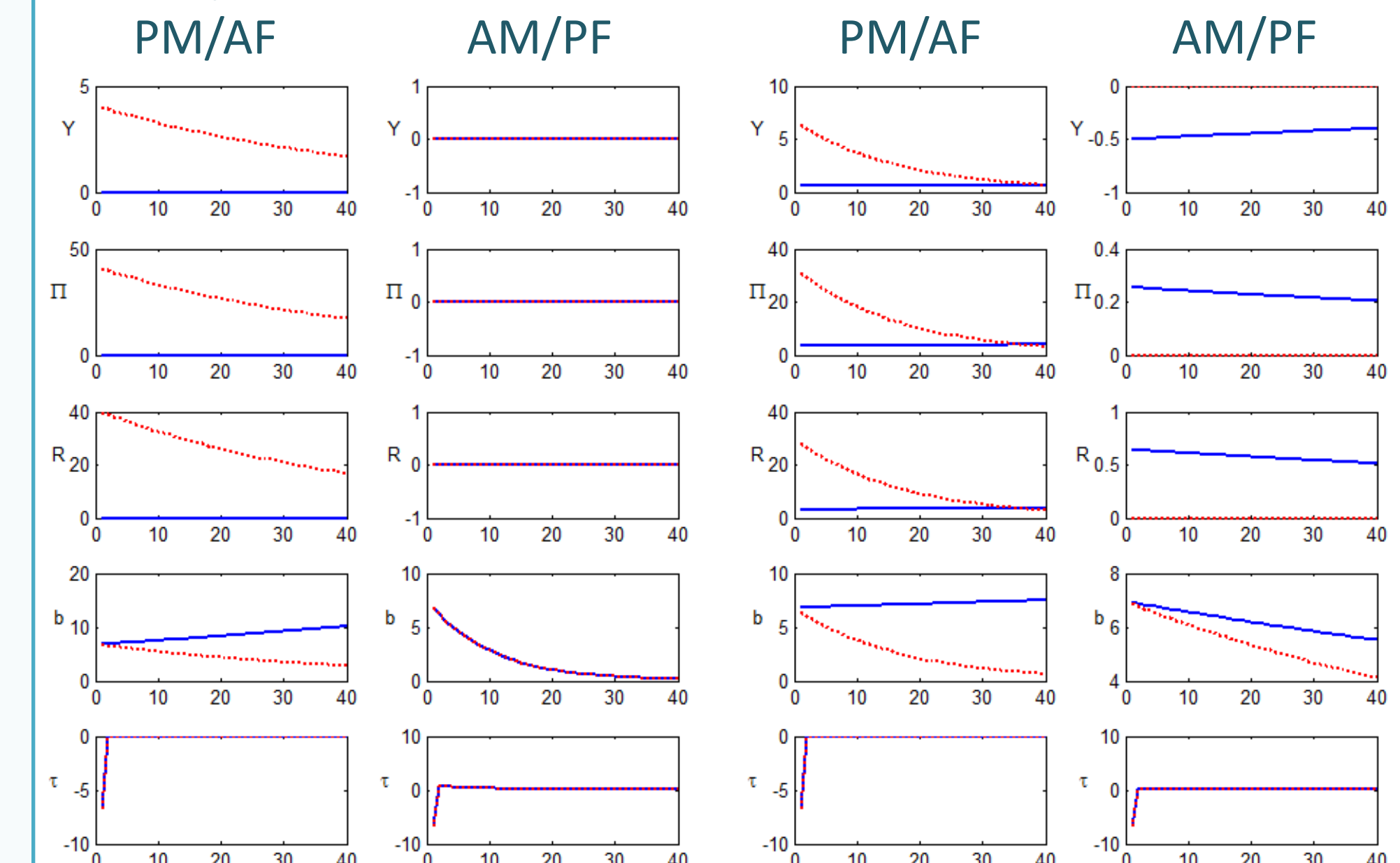
- Red lines: fixed coefficients model

- Blue lines: MS model

- Left panel: $(\gamma_{\tau,1}, \gamma_{\tau,2}) = (0, 0.2)$; $(\gamma_{\pi,1}, \gamma_{\pi,2}) = (0.97, 2.5)$
  → **right of MPF and FPF**

  1. look at blue lines: in the PM/AF regime, the possibility to go towards the Ricardian regime (with $p_{12} = 0.05$) makes the IRFs (except for debt) behave as in the Ricardian regime (i.e. inflation does not increase)

  2. Not only expectation effects are asymmetric (larger under PM/AF than under AM/PF) but in the AM/PF regime when MP is above the MPF (and there is determinacy) **there are no expectation wealth effects**

  → Intuition: being to the right of FPF means that fiscal policy is "on average passive". Hence, on average, fiscal policy does not cause wealth effects

- Right panel: $(\gamma_{\tau,1}, \gamma_{\tau,2}) = (0, 0.045)$; $(\gamma_{\pi,1}, \gamma_{\pi,2}) = (0.9, 2.5)$
  → **determinacy but left of MPF**

  1. does not hold anymore (i.e. inflation increases)

  2. expectation effects are asymmetric and in the AM/PF regime there are wealth effects