Private Fiscal Information and Sovereign Default Risk

Siming Liu [1] Ruoyun Mao [2] Hewei Shen [3]

[1]Shanghai University of Finance and Economics

[2]Grinnell College

[3]University of Oklahoma

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Motivation

- Bond yields decouple across European countries after 2008.

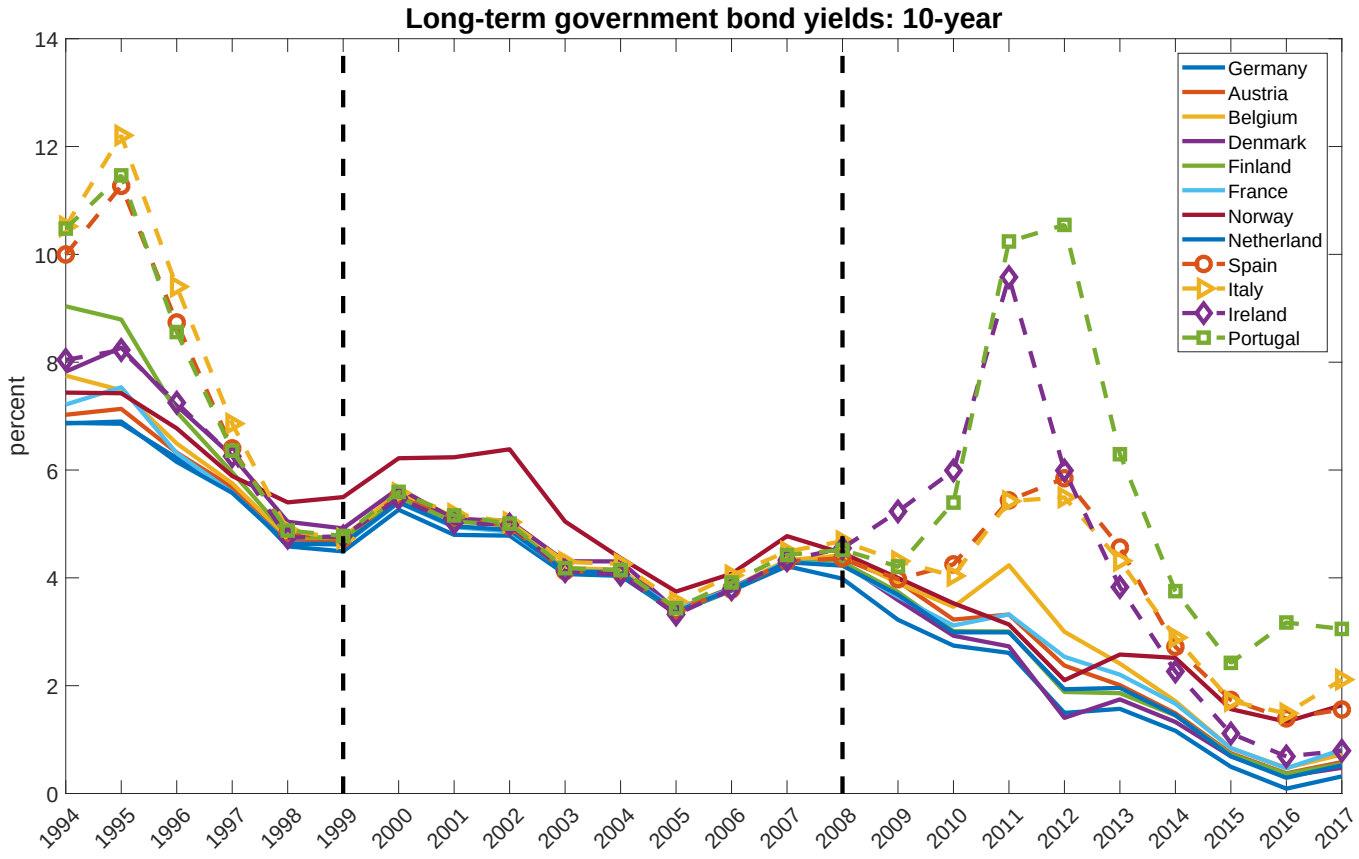

Figure 1: Government bond yields: 10-year

Main Questions

1. What cross-country heterogeneity can explain the divergence of bond yields after 2008 financial crisis?
2. How does the cross-country heterogeneity hide from 2000 to 2008?

Motivation

- No obvious decoupling in fundamentals.

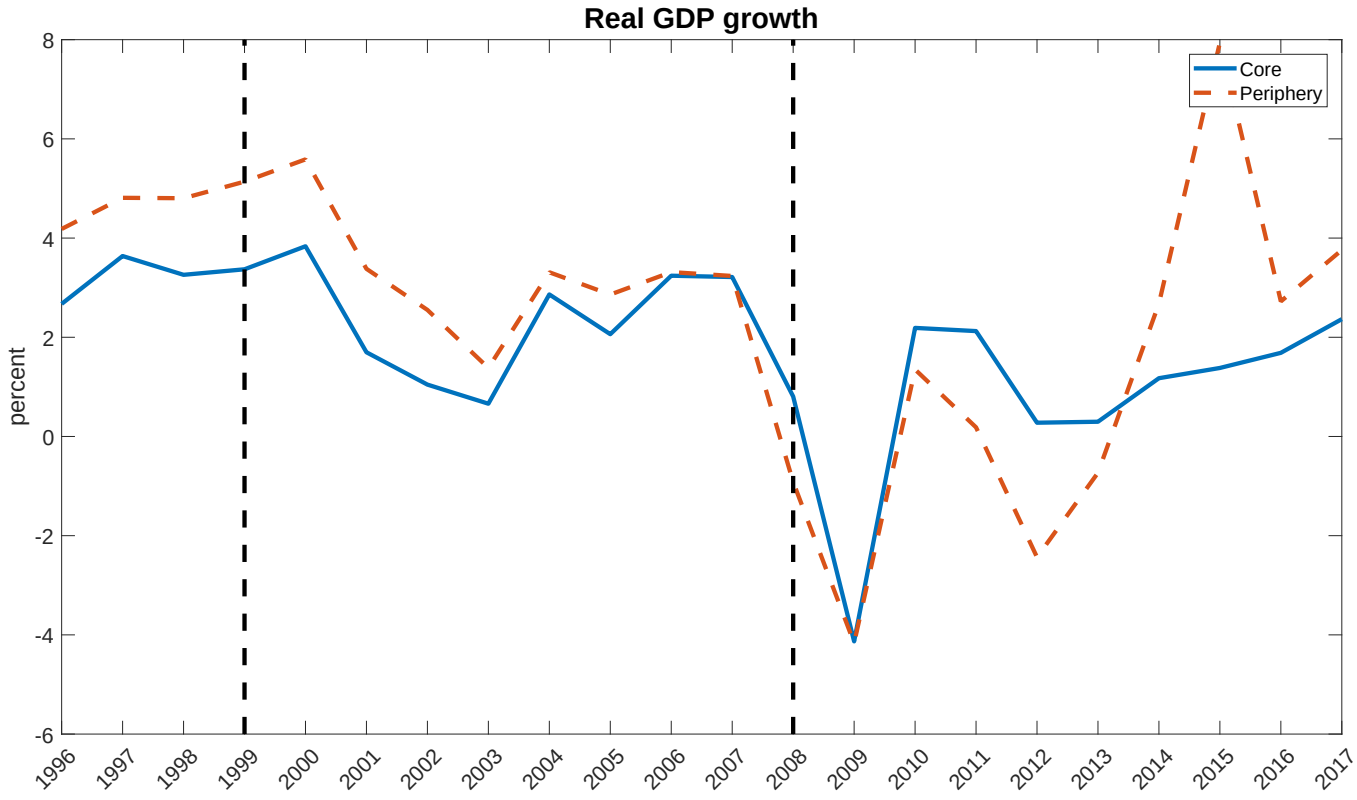

Figure 2: GDP growth rate: core and periphery

This paper

- introduce private fiscal information into sovereign default model
- Two types of governments
  - credible: commit future tax rates $\Rightarrow$ " Type C government"
  - non-credible: discretionary tax rates $\Rightarrow$ " Type D government"

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  - credible: commit future tax rates $\Rightarrow$ " Type C government"
  - non-credible: discretionary tax rates $\Rightarrow$ " Type D government"
- Credible government can borrow at a more favorable bond price schedule.
- Type unknown to the foreign investor, to enjoy a more favorable bond price motivation
  - Type D wants to hide its type
  - Type C wants to signal its type

This paper (Cont'd)

- During normal times, type D and type C are indistinguishable in equilibrium.
  - " Pooling Equilibrium"
- During crisis when debt market environment changes, government type is revealed in equilibrium.
  - "Separating Equilibrium"
    - impatient government
    - low default tolerance

Model Environment

- two periods, t = 1, 2
- a sovereign borrower and risk neutral foreign investors
- private consumption good c and public consumption good g, valued by
  - $u(g_1) = \frac{g_1^{1-\sigma}}{1-\sigma}$
  - $u(c_2, g_2) = (1-\pi)\frac{c_2^{1-\sigma}}{1-\sigma} + \pi\frac{g_2^{1-\sigma}}{1-\sigma}$

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- t $= 1$, no endowment; t $= 2$, stochastic endowment y_2
  - t $= 1$, issues one period bond b_2 to finance public consumption g_1;
  - t $= 2$, to repay debt and finance consumption, choose default or collect an income tax τ;

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  - t $= 1$, issues one period bond b_2 to finance public consumption g_1;
  - t $= 2$, to repay debt and finance consumption, choose default or collect an income tax τ;
- Tax rate τ is chosen and announced at $t = 1$.
  - Credible government: implement τ regardless
  - Non-credible government: if defaults, it is able to implement ex post optimal tax rate τ^*

Event Timing

1. Government chooses tax rate τ to be implemented next period and borrows to finance government consumption;
2. Nature draws y_2;
3. Given endowment realization and announced tax rates, the government chooses to default or not.
   - If type C, implements τ;
   - If type D defaults, it can choose and implement τ^*;

Full Information Benchmark: Optimization Problem

- Period 1 problem for type C:

$$V_1^C = \max_{b_2,\tau} u(g_1) + \beta \mathbb{E}[V_2^C(b_2, \tau, y_2)]$$
$$s.t. \quad g_1 = b_2 q^C(b_2, \tau)$$

where

$$V_2^C(b_2, \tau, y_2) = \max\{V_2^{RC}(b_2, \tau, y_2), V_2^{DC}(\tau, y_2)\}$$
$$V_2^{RC}(b_2, \tau, y_2) = u((1-\tau)y_2, \tau y_2 - b_2)$$
$$V_2^{DC}(\tau, y_2) = u((1-\tau)\phi y_2, \tau \phi y_2)$$

Full Information Benchmark: Optimization Problem

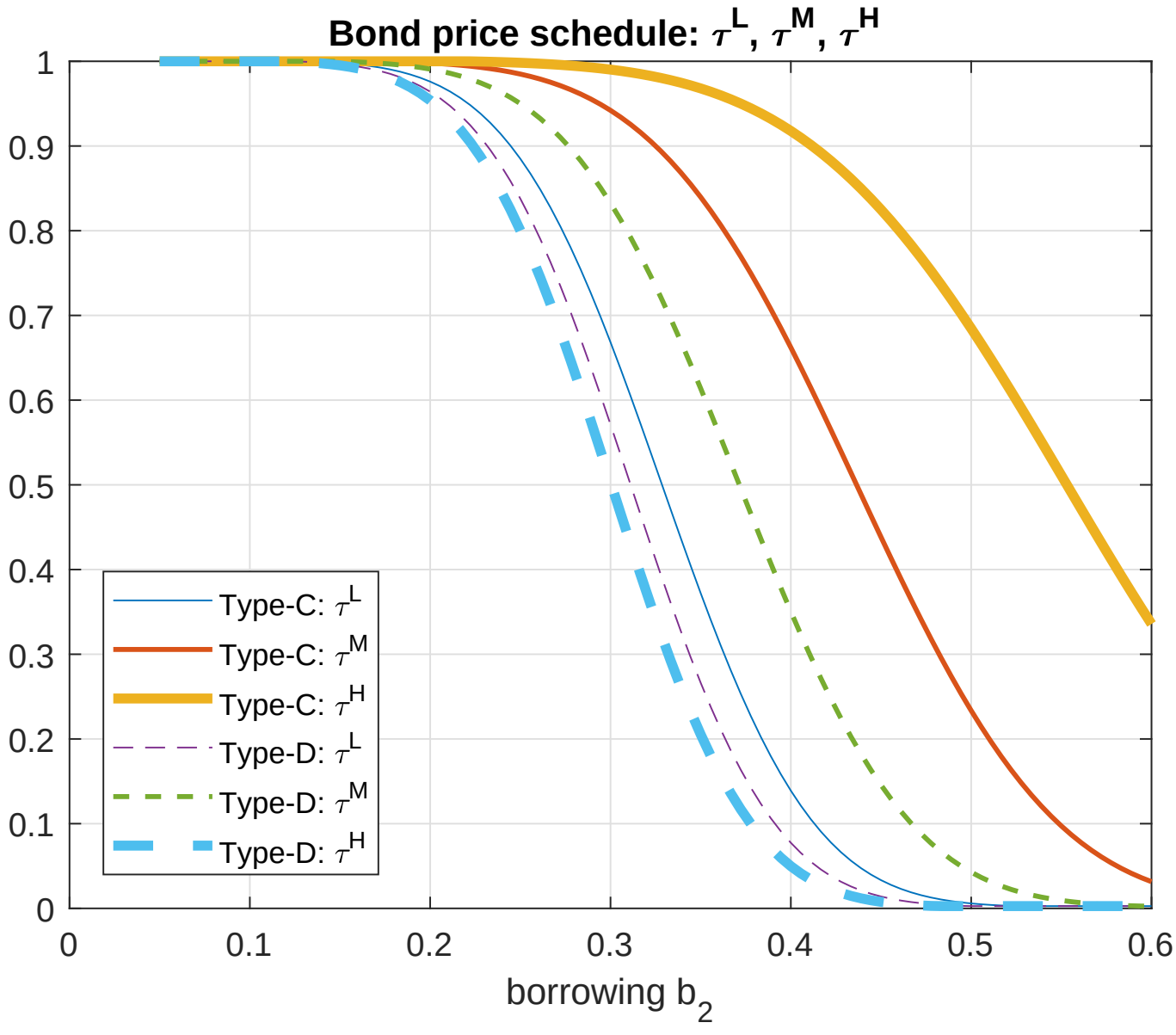
- Period 1 problem for type D:

$$V_1^D = \max_{b_2,\tau} u(g_1) + \beta \mathbb{E}[V_2^D(b_2, \tau, y_2)]$$
$$s.t. \quad g_1 = b_2 q^D(b_2, \tau)$$

where

$$V_2^D(b_2, \tau, y_2) = \max\{V_2^{RD}(b_2, \tau, y_2), V_2^{DD}(\tau, y_2)\}$$
$$V_2^{RD}(b_2, \tau, y_2) = u((1-\tau)y_2, \tau y_2 - b_2)$$
$$V_2^{DD}(y_2) = \max_{\tau^*} u((1-\tau^*)\phi y_2, \tau^* \phi y_2)$$

Full Information Benchmark: Bond price



Full Information Benchmark: Optimal Tax

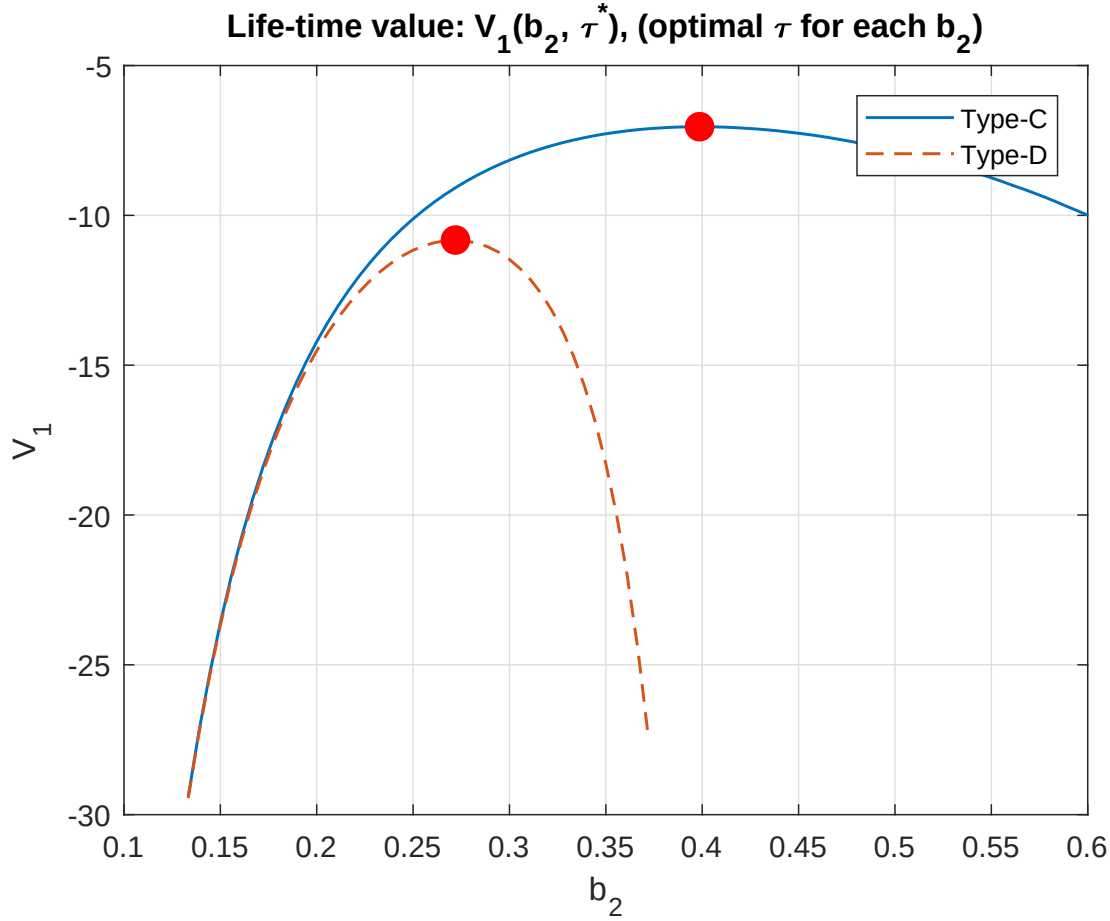


Figure 3: Life-value as functions of τ

- Type C government: high tax rate
- Type D government: low tax rate

Private Information on Government Type

- Government has private information about its own type;
- Foreign investors don't know the type and have a prior $\mathbb{P}(\textit{type} = C) = \alpha$;
- Foreign investors observe government's announcement of the tax rate and update their belief about the type.

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- To win a favorable price schedule,
  - Type-D government has incentive to announce a higher tax rate to hide its type.
  - Type-C government has incentive to announce a higher tax rate to signal its type.

Private Information: Bayesian Updating

In period 1, type-C government's problem:

$$V_1^C = \max_{b_2,\tau} u(g_1) + \beta \mathbb{E} V_2^C(b_2, \tau, y_2)$$
$$s.t. \quad g_1 = b_2 q(b_2, \tau, \mu(\tau))$$

where

$$\mu(\tau) = \mathbb{P}(type = C|\tau) = \frac{\mathbb{P}(\tau|type = C)\alpha}{\mathbb{P}(\tau|type = C)\alpha + \mathbb{P}(\tau|type = D)(1-\alpha)}$$

Bond price is determined by:

$$q(b_2, \tau, \mu) = 1 - [\mathbb{P}(d(b_2, \tau) = 1|typeC)\mu(\tau) + \mathbb{P}(d(b_2, \tau) = 1|typeD)(1 - \mu(\tau))]$$

Equilibrium: pooling v.s. separating

- Two kinds of equilibria:
  - separating equilibrium: fully revealed type
  - pooling equilibrium: zero new information from government's behavior
- Equilibrium is selected by Type C government's utility, given Type D government's incentive to mimic.
  - pool equilibrium: Type C government finds it too costly to separate.

Equilibrium: pooling v.s. separating

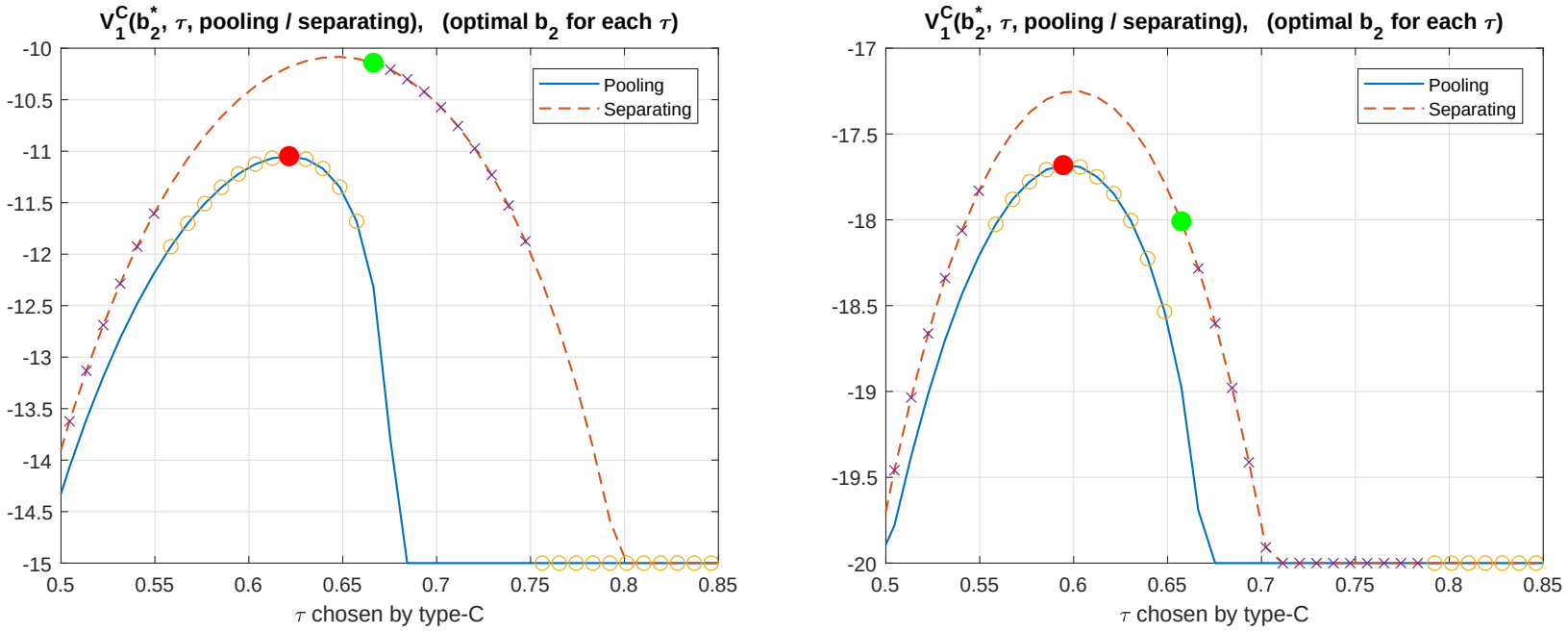

Figure 4: Equilibrium selection: Separating vs pooling

Note: $\beta = 2$ in the left panel and $\beta = 5$ in the right panel. $\alpha = 0.6$, $\phi = 0.62$

Equilibrium: Pooling v.s. Separating

Table 1: Pooling V.S. Separating

	Pooling		Separating	
Low β	type-C	type-D	type-C	type-D
tax rate	0.62	0.62	0.67	0.61
life-time value	-11.05	-10.40	-10.14	-11.64
High β	type-C	type-D	type-C	type-D
tax rate	0.59	0.59	0.66	0.59
life-time value	-17.68	-16.75	-18.01	-17.56

Comparative Statics: Impatience

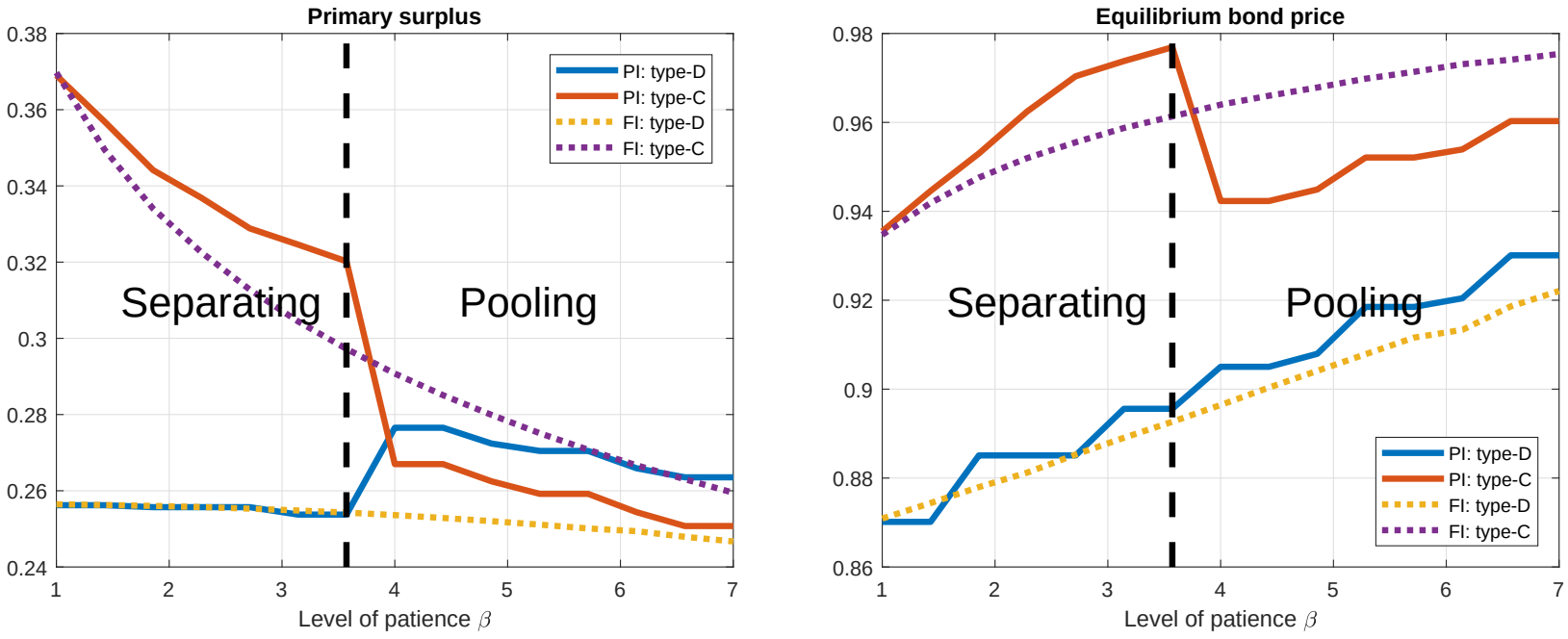

Figure 5: Level of impatience

- Impatience increases $\Rightarrow$ More borrowing $\Rightarrow$ Larger incentive for Type D government to pool $\Rightarrow$ Larger incentive for Type C government to separate
- The separating incentive dominates.

Comparative Statics: Debt Tolerance

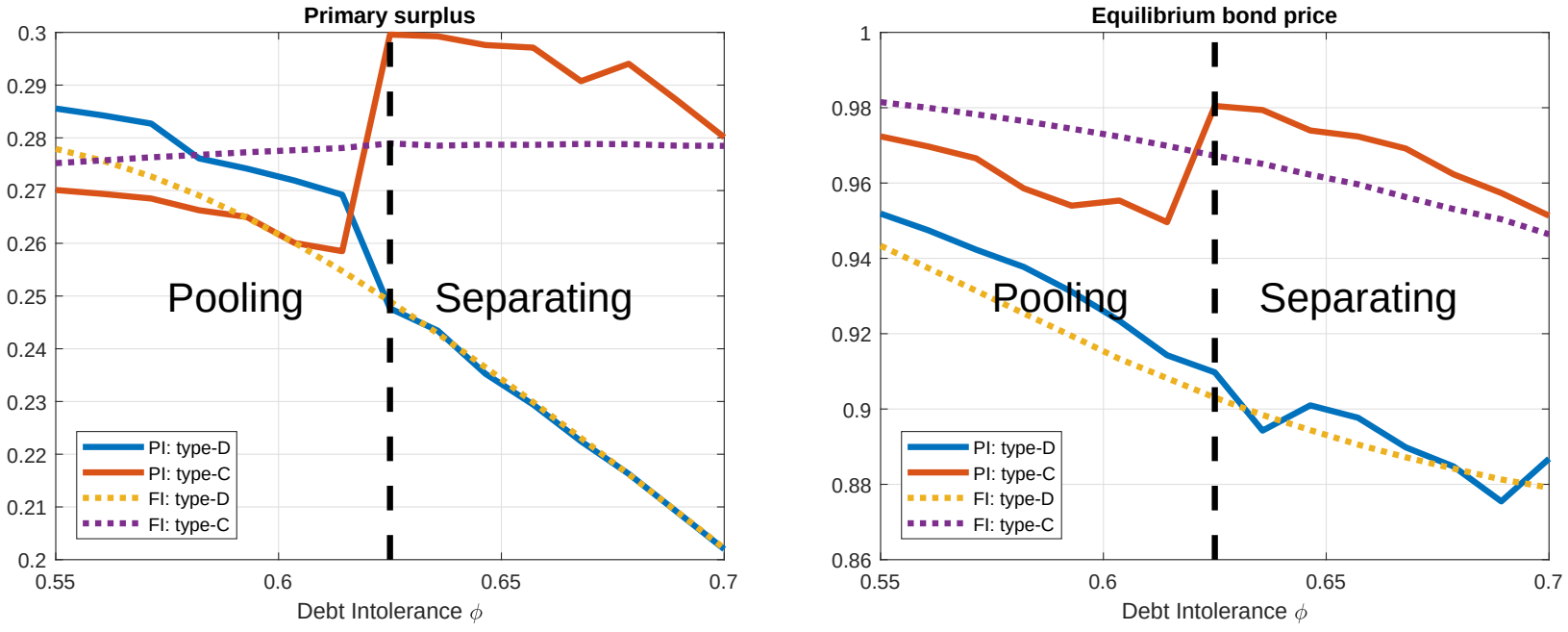

Figure 6: Debt Intolerance (1-ϕ is the cost)

- high $\phi \Rightarrow$ low default cost $\Rightarrow$ default incentive increases $\Rightarrow$ the value of fiscal commitment increases $\Rightarrow$ Type C government's incentive to separate becomes stronger

Conclusions and Future Works

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- Introduce signaling game into sovereign default model to explain the yield decoupling observed in Euro zone after 2008.
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Future Works

- Current model is too simple for quantitative analysis.
- One shot game: once the type is revealed, it's known.

Motivation

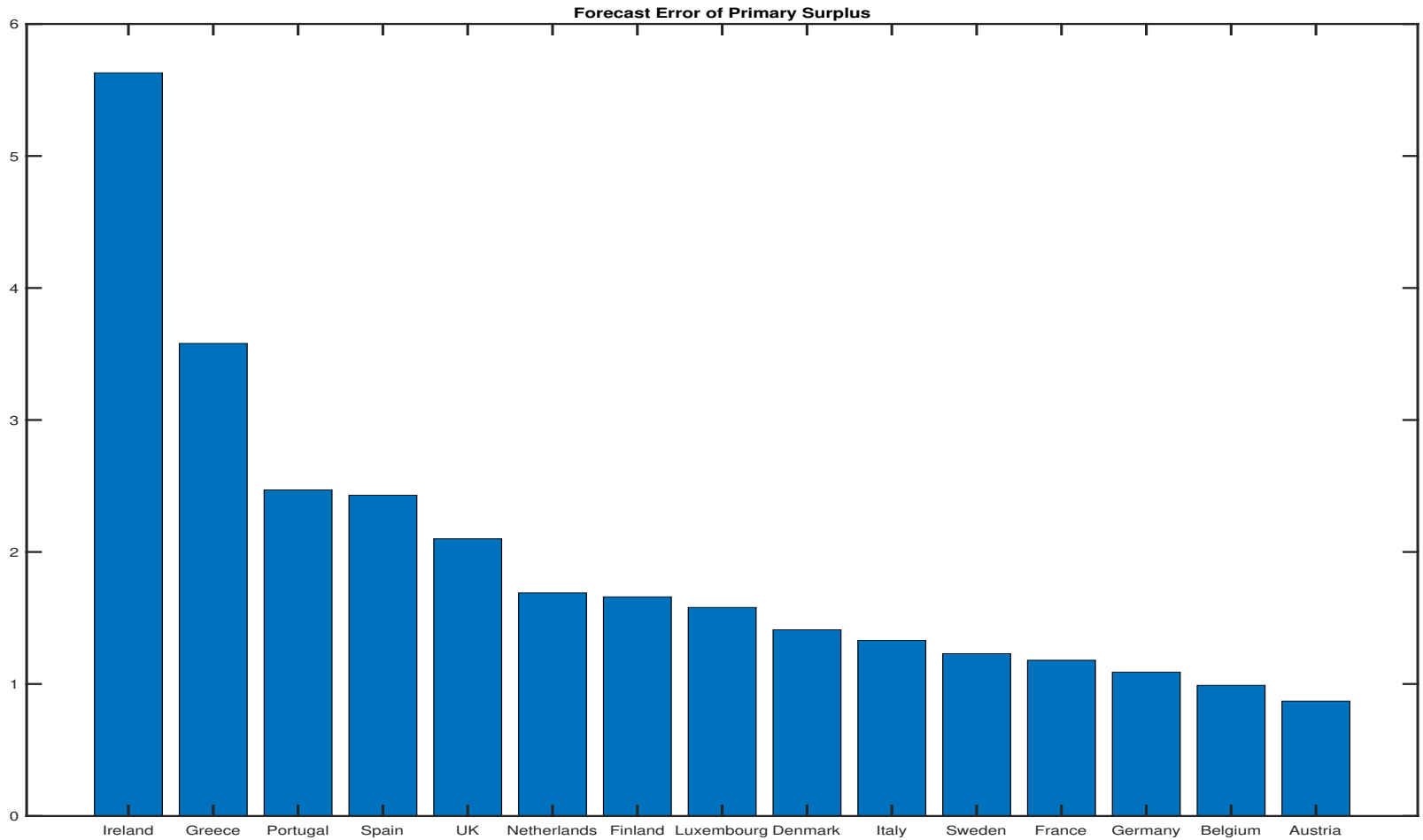

Figure 7: EC's Forecast Error of Primary Surplus (absolute values, 2003-2013) back