On the optimal design of a Financial Stability Fund

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Three related themes

I. Risk-sharing and stabilization policies in normal times.

II. Dealing with severe crises (i.e. achieving resilience).

III. Resolving a debt crisis (e.g. the euro ‘debt overhang’).

I. Risk-sharing in the EMU

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- with **a fiscal union budget** and fiscal automatic stabilizers?
  (***% of non-smoothed GDP shocks***: 20% DE; 25% US; 70% EA(15; 1978-2010); (Furceri and Zdzienicka 2015); 83% EA(19; 1995-2015) (Lanati 2016))
- with private borrowing and risk-sharing within the *European Banking Union*?
- with public fiscal stabilization by relaxing even more the *Stability and Growth Pact*?
- or wait to "the medium term, as economic structures converge towards the best standards in Europe" (*Five Presidents' Report*, 2015)?

II. Dealing with severe crises

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- A crisis resolution mechanism?

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(Crises becoming recessions?: **Greece has just entered its third recession since 2010!**)

- A crisis resolution mechanism? The European Stability Mechanism

  If indispensable to safeguard the financial stability of the euro area as a whole and of its Member States, the ESM may provide stability support to an ESM Member subject to strict conditionality, appropriate to the financial assistance instrument chosen.

III. Resolving debt overhang problems

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- by debt restructuring? (and further austerity?)
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- by transforming sovereign debts into Eurobonds?
- by transforming short-term sovereign debt into long-term debt through the ESM?

  (the ESM is holding 50% of Greece's sovereign debt – it amounts to 88.5% of Greece GDP– as long-term, over 30 years, *unconditional* debt)

Designing a *Financial Stability Fund*

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- As a (constrained) optimal risk-sharing mechanism (I), which can also help with (II) and (III).
- **An EMU is a long-term self-enforcing partnership**.
- Long-term contracts can provide risk-sharing and enhance borrowing & lending and investment opportunities.
- Long-term *ex-post* conditional transfers, in contrast with unconditional debt contracts with *ex-ante* ('austerity programs') conditions.
- Normal-times-transfers 'build trust', in contrast with crisis-relief-transfers which tend to create 'stigma & resentment'.

A *Financial Stability Fund* as a Dynamic Mechanism Design problem

A well designed *Fund* must take into account 3 problems:

The redistribution problem: risk-sharing transfers should not become *ex-post* persistent, or permanent, transfers (Hayek's problem).

The moral hazard problem: the severity of shocks may depend on which policies and reforms are implemented.

The asymmetry problem: there may not be an *ex-ante* 'veil of ignorance' and countries may start with large (debt) liabilities.

The environment

One infinitely-lived risk-averse government with

- preferences: $U(c, n, e) \equiv u(c) + h(1 - n) - v(e)$ & β,
- technology: $y = \theta f(n)$
- and subject to productivity, θ & government expenditure G shocks;
- governmental effort, e, decreases the probability of high government expenditure realizations.

Two alternative borrowing & lending regimes

1. *Incomplete markets* with default (IMD) and a risk-free rate r: $1/(1+r) \geq \beta$.

   - countries smooth shocks, and borrow and lend, with long-term non-contingent debt;
   - there can be default (full, in our case);
   - default is costly and the country has no access to international financial markets, temporarily.

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2. *Financial Stability Fund* (Fund) as a risk-neutral agent with discount $1/(1+r) \geq \beta$.
   - a country could leave the Fund at any time, in which case is like a country who defaults in an IMD regime;
   - persistent transfers are limited by the amount of redistribution that is mutually accepted;
   - there are incentives for countries to apply policies which reduce risks.

Quantitative analysis to address questions like:

- How different would the evolution of an economy be with the Fund vis-a-vis using Debt with possible default?

  (e.g. How different would had been the Greek experience within a EA Fund?)

- How much would the borrower gain?

- How can very heterogeneous countries – say, in labour productivity – share risks, without incurring undesired permanent transfers?

- What is the maximum amount of a country's debt that the Fund can absorb?

Incomplete markets with default: Long-term Bond

Following Chaterjee and Eyigungor (2012), a long-term bond is parameterized by (δ, κ), where

- δ is the probability of continuing to pay out coupon in the current period.
- $(1-\delta)$ is the probability of maturing in the current period (i.e $\delta = 0$ is one-period debt)
- κ is the coupon rate (possibly $\kappa = 0$)

Given a constant discount rate r, and no default risk, the price of a unit bond equals to

$$\mathfrak{q} = \sum_{t=0}^{\infty} [(1-\delta) + \delta\kappa] \frac{\delta^t}{(1+r)^{t+1}} = \frac{(1-\delta) + \delta\kappa}{r + 1 - \delta}.$$

Incomplete markets with default

If a borrower does not default on her outstanding debt debt, $(-b)$, in state s the value of the 'debt contract' is:

$$V_n^b(b,\ s) = \max_{c,n,e,b'} \left\{ U(c,n,e) + \beta \mathrm{E} \left[V^b(b',\ s') \mid s, e \right] \right\}$$

$$\text{s.t.} \quad c + G + q(s,b,b')(b' - \delta b) \leq \theta f(n) + (1 - \delta + \delta\kappa)b,$$

where, taking into account that default can occur next period,

$$V^b(b,\ s) = max\{V_n^b(b,\ s), V^a(s)\}$$

Assumption: Effort e, is not observable/contractable by the market.

Implication: The bond price $q(s,b,b')$ may depend on the current level of debt as e does.

Incomplete markets with default (IMD)

- The value in autarky is given by

$$V^{a}(\, s) = \max_{n,e}\{u\left(\theta^{p}(\theta) f\left(n\right) - G\right) + h(1-n) - v(e)$$

$$+\, \beta \mathrm{E}\left[\left(1-\lambda\right) V^{a}(s') + \lambda V^{b}\left(0,\, s'\right) \mid s, e\right]\}$$

- There is a 'default penalty' modelled as a drop in productivity, from θ to θ^{p}.

- After default a government is in autarky, but can re-enter the financial (incomplete) market with probability λ; λ small.

Incomplete markets with default (IMD)

- The choice of default: $D(\,s, b) = 1$ if $V^a(\,s) > V_n^b(b,\;s)$ and 0 otherwise.
- The expected default rate: $d(s, b, b') = \mathrm{E}\left[D(s',\;b')\mid\; s, e^*(s, b)\right]$
- The price of new debt is:

$$q(s, b, b') = (1-\delta)\frac{1-d(s, b, b')}{1+r} + \delta\frac{\mathrm{E}\left[\left(1-D(s',\;b')\right)\left(\kappa + q(s',\;b', b''(s',\;b'))\right)\mid\; s, e^*(s, b)\right]}{1+r}$$

- The 'stationary' interest rate on debt is: $r^i(s, b, b') = \frac{(1-\delta)+\delta\kappa}{q(s,b,b')} - (1-\delta)$
- **The 'stationary positive spread' is:** $r^i\left(s, b, b'\right) - r \geq 0$

Incomplete markets accounting

- Primary surplus (we also call it transfers, τ, and primary deficit if negative)

$$q(s,b,b')(b'-\delta b)-(1-\delta+\delta\kappa)b=\theta f\ (n)-(c+G)$$

The *Financial Stability Fund* as a long-term contract

- We use the theory of *Recursive Contracts* (Marcet & Marimon (2017)) to characterize the optimal long-term contract, which is subject to:

  intertemporal participation constraints to guarantee that none of the agents wants to quit when there are still joint gains to be shared;

  moral hazard constraints to guarantee that efforts to reduce risks are made.

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- We 'price' these contracts as if agents where exchanging *state-contingent assets* subject to *e*ndogenous constraints; then histories are summarized by the asset holdings.

The *Financial Stability Fund* as a long-term contract

- As a planner's problem with initial weights $\mu_{b,0}$ and $\mu_{l,0}$ for the lender and the borrower,
- where $\mu_{l,0}/\mu_{b,0}$ guarantees the *ex-ante* zero profit condition for the lender.
- The outside value of the borrower is $V^a(s)$, as in the IMD economy.
- $Z \leq 0$ is the *ex-post* outside value of the lender.

The Fund contract as long term state-contingent assets

- S **securities** parameterized by (δ, κ, s), where (δ, κ) denote the common coupon and duration probability.
- (δ, κ, s) only pays coupon or the maturity value in state s.
- Agents hold a continuum of these portfolios

$$W^b(a,\ s) = \max_{(c,n,e,a'(s'))} \left\{ U(c,\ n,\ e) + \beta \mathbb{E}\left[W^b(a', s') \mid s \right] \right\}$$

$$\text{s.t. } c + \sum_{s'|s} q\left(s'|s\right)\left(a'(s') - \delta a(s)\right) \le \theta(s) f(n) - G(s) + (1 - \delta + \delta\kappa)\, a(s)$$

$$a'(s') \ge A_b\left(s'\right)$$

The Fund contract as long term state-contingent assets

- $q\left(s'|s\right)$ is the price of a (δ, κ, s') asset in state s,
- $a_b'\left(s'\right)$ are the end-of-period asset (contingent claims) holdings,
- $A_b\left(s'\right)$ **is an endogenous borrowing limit**: $W^b(A_b\left(s\right), s) = V^a(s)$.

The Fund contract as long term state-contingent assets

Similarly, for the the lender, who receives the coupon and maturity value

$$W^l(a,\ s) = \max_{\left(c,\, a'(s')\right)} \left\{ c + \frac{1}{1+r} \mathbb{E}\left[W^l(a', s') \mid s \right] \right\}$$

$$\text{s.t. } c + \sum_{s'|s} q\left(s'|s\right) \left(a'(s') - \delta a(s)\right) = \left(1 - \delta + \delta\kappa\right) a(s)$$

$$a'\left(s'\right) \geq A_l\left(s'\right)$$

Fund decentralization

$$q^*\left(s'|s\right) = \frac{1}{1+r}\pi\left(s'|s\right)\left[(1-\delta+\delta\kappa)+\delta q\left(s'\right)\right]\max\left\{\frac{1+v_l(x',s')}{(1+v_b(x',s'))}\frac{1}{1+\frac{\varphi(s'|x,s)}{1+v_b(x,s)}},1\right\}$$

- the ***price of a one-period bond*** $q^f(s) = \sum_{s'|s} q^*\left(s'|s\right)$,
- the implicit interest rate $r^f(s) = \frac{1-\delta+\delta k}{q^f(s)}$
- and the ***negative spread***: $r^f\left(s^t\right) - r \leq 0.$

Fund accounting

- Primary surplus (we also call it transfers or primary deficit if negative)

$$\sum_{s'|s} q^* \left(s'|s\right) \left(a_b'(s') - \delta a_b'(s)\right) - \left(1 - \delta + \delta k\right) a_b'(s) = c_l(s) = \tau^*(x, s).$$

Calibration: functions and parameters

- Utility:
$$\log(c) + \gamma \frac{(1-n)^{1-\sigma} - 1}{1-\sigma}, \quad \text{with } \sigma = 0.69, \gamma = 1.4.$$
Production: $f(n) = n^{\alpha}$, with $\alpha = 0.566$.
- Borrower's discount factor $\beta = 0.945$, while $r = 2.48\%$.
- The probability of returning to the IMD market after default (quit) is $\lambda = 0.15$; default/quit penalty
$$\theta^p(\theta) = \begin{cases} \psi \mathbb{E}\theta, & \theta \geq \psi \mathbb{E}\theta \\ \theta, & \theta < \psi \mathbb{E}\theta \end{cases} \quad \text{with } \psi = 0.81.$$
- IMD long-term bond: $\delta = 0.814$, $\kappa = 8.3\%$.
- **Tight** limited enforcement constraint of the Fund: $Z = 0$!

A *PIIGS* calibration

- Annual data for PIIGS countries over 1980–2015, main source: AMECO.
- Construct labor productivity using aggregate working hours for each country; fit the productivity series with a panel Markov regime switching model; discretize the MS process into a 27-state Markov chain:
  Best state: $\theta_{27} \equiv e27$, . . ., worst state: $\theta_1 \equiv e1$
- Calibrate the G shock with a 3-state Markov chain, featuring persistent 'crisis' state:
  Best state: $G_3 \equiv g3$, . . ., worst state: $G_1 \equiv g1$
- Stochastic processes calibrated to the PIIGS countries up to the euro crisis.

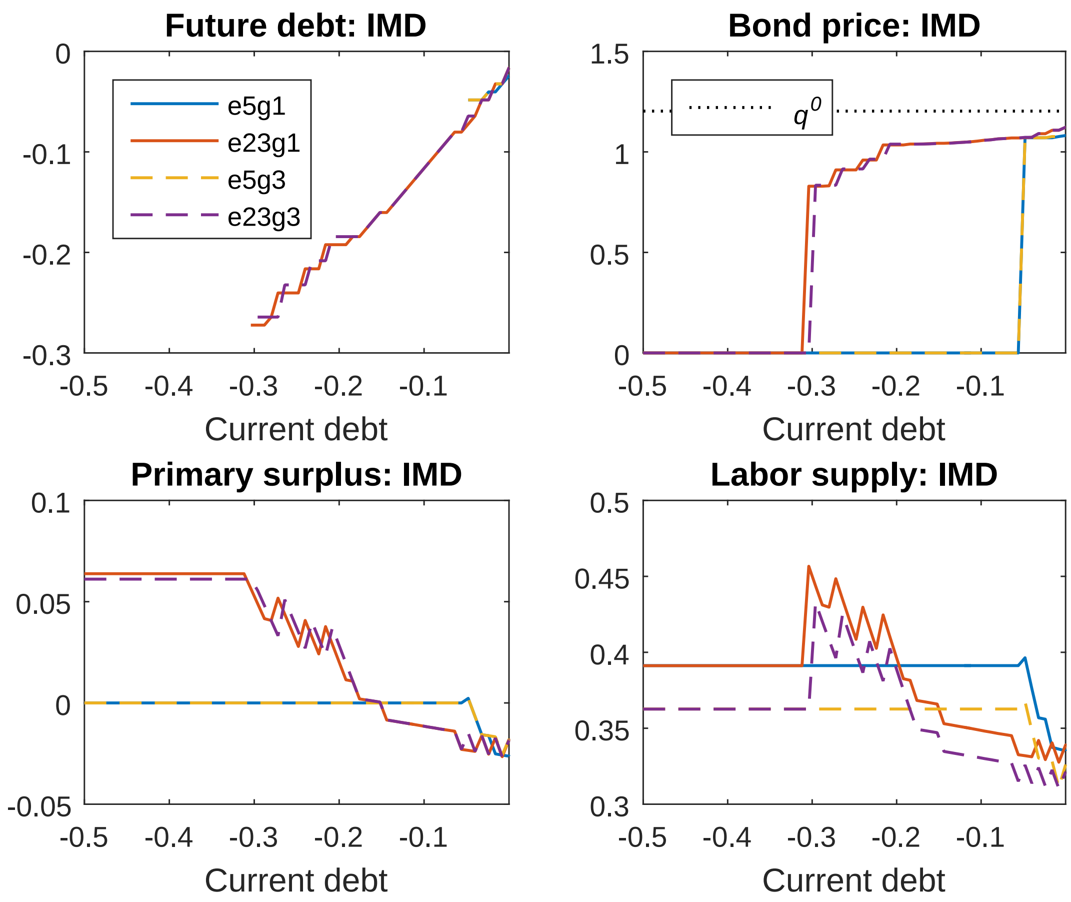
Model fit

1^{st} Moments	Data	Model (IMD)
Mean		
Debt to GDP ratio	77.29%	76.56%
Real bond spread	3.88%	3.76%
G to GDP ratio	20.18%	19.62%
Percentile: 1 & 99	$[13.48\%, 32.79\%]$	$[11.56\%, 33.02\%]$
Primary surplus to GDP ratio	-0.78%	1.30%
Fraction of working hours	36.74%	37.28%
Maturity	5.38	5.38

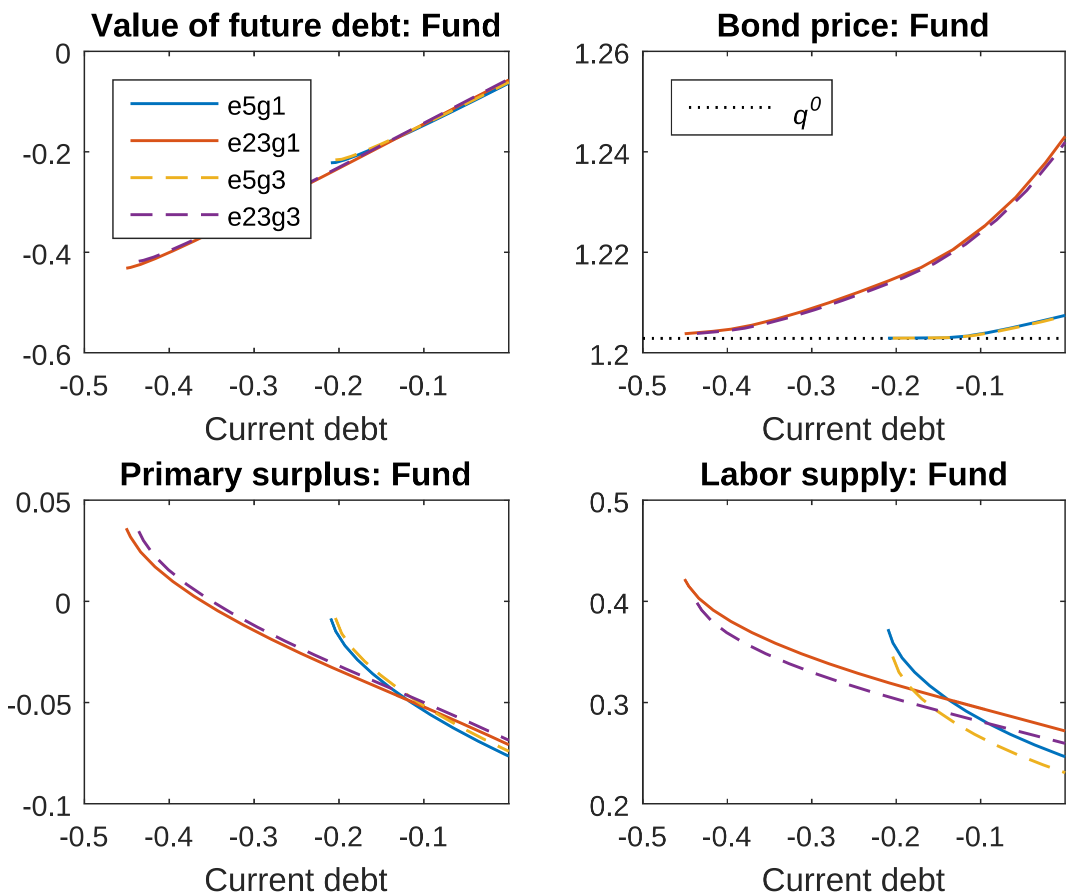
2^{nd}Moments	Data	Model (IMD)
Volatility		
$\sigma(C)/\sigma(Y)$	1.49	1.47
$\sigma(N)/\sigma(Y)$	0.92	0.69
$\sigma(G)/\sigma(Y)$	0.91	0.86
$\sigma(PS/Y)/\sigma(Y)$	0.65	0.80
σ(real spread)	1.53%	0.93%
Correlation		
$\rho(C, Y)$	0.88	0.76
$\rho(N, Y)$	0.67	-0.13
$\rho(PS/Y, Y)$	-0.29	0.11
$\rho(G, Y)$	0.35	0.07
ρ(real spread, Y)	-0.35	-0.29
$\rho(G_t, G_{t-1})$	0.94	0.94

Optimal policies

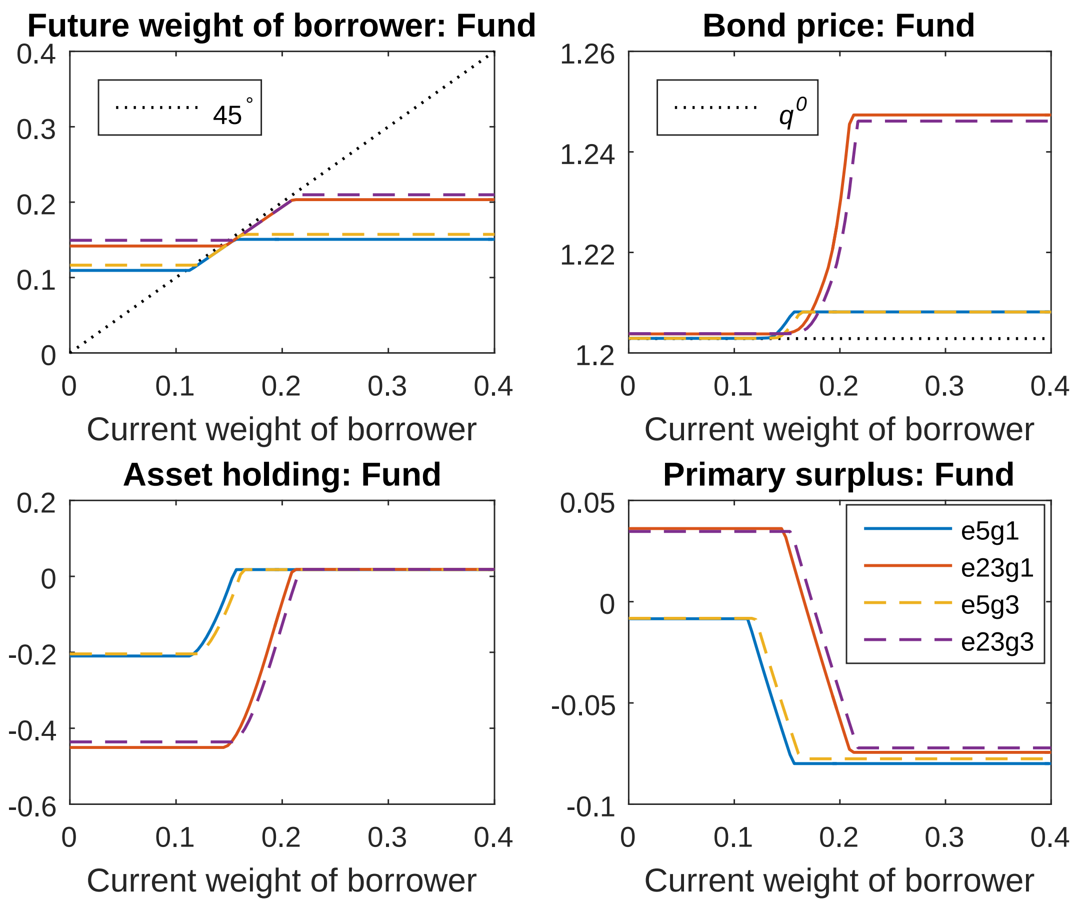
Optimal policies for incomplete markets with default



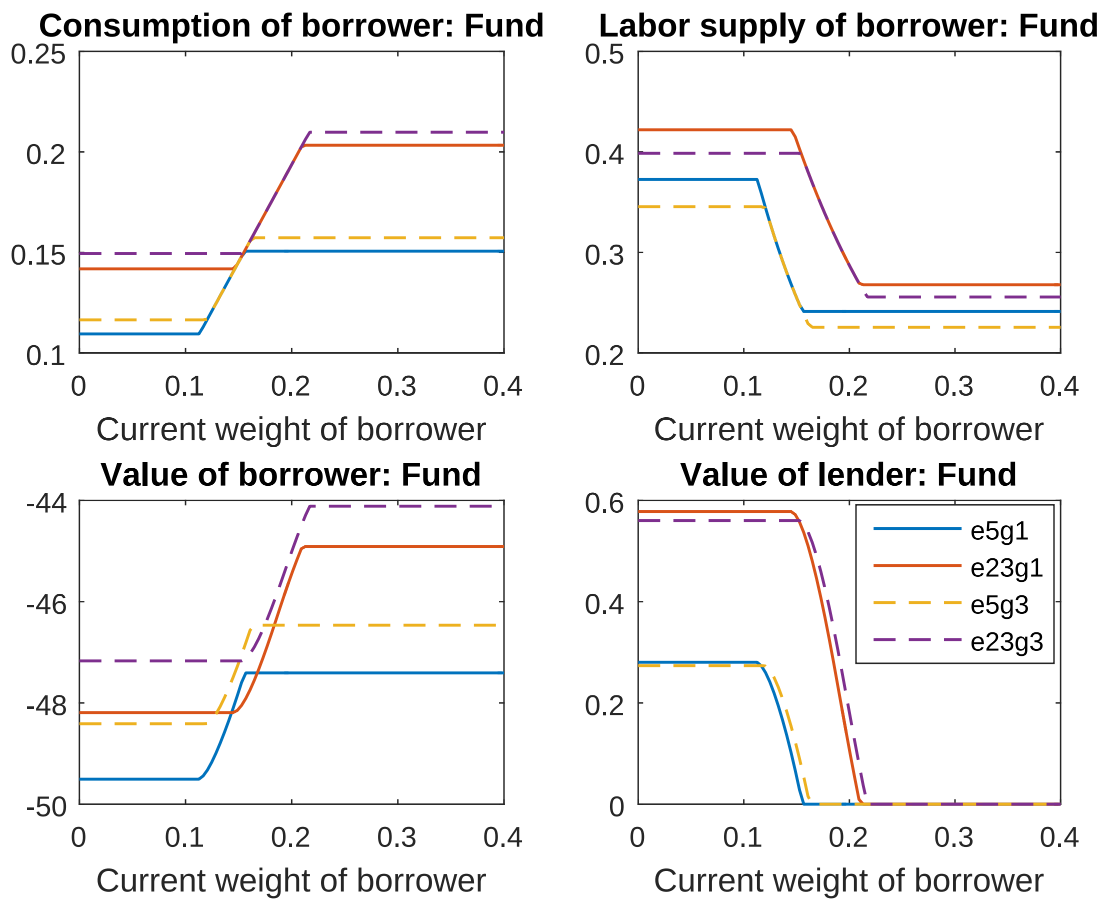
Optimal policies for the fund (in assets)



Optimal policies for the fund: Pareto weights and assets

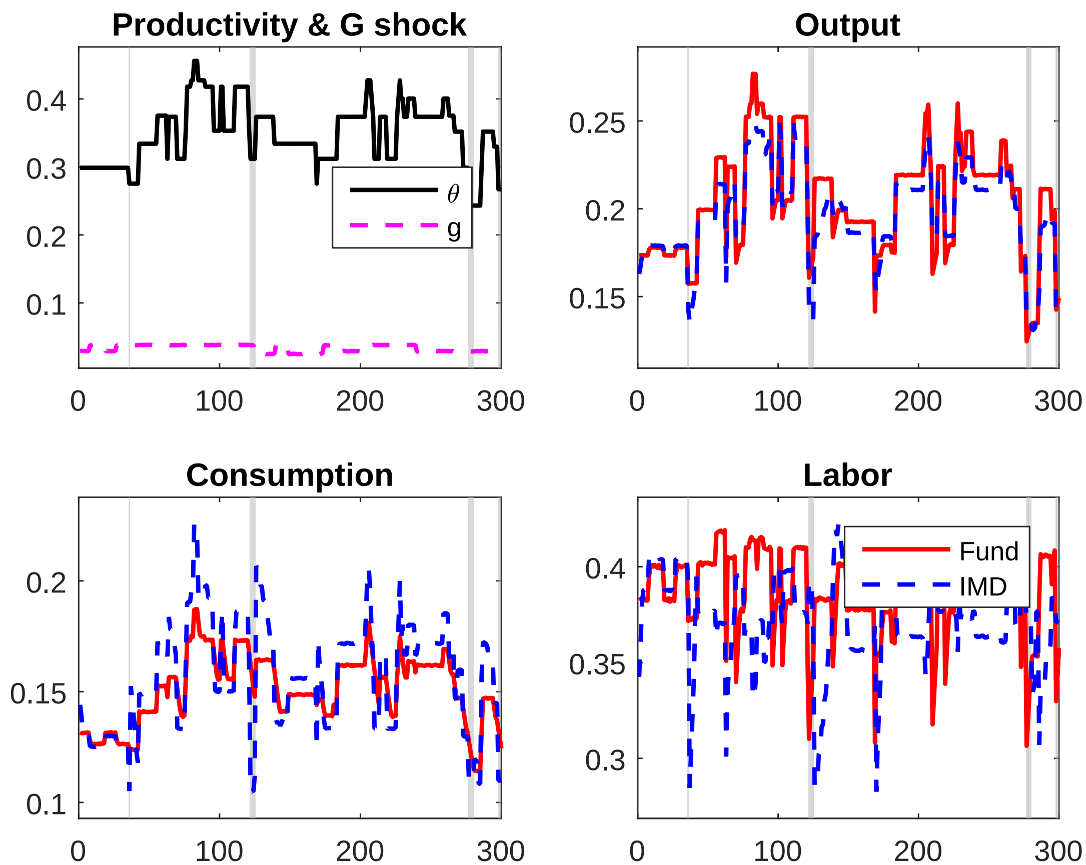


Optimal policies for the fund: allocations and values



Comparing the economies in normal times

IMD vs. Fund Business Cycle Paths: shocks and allocations



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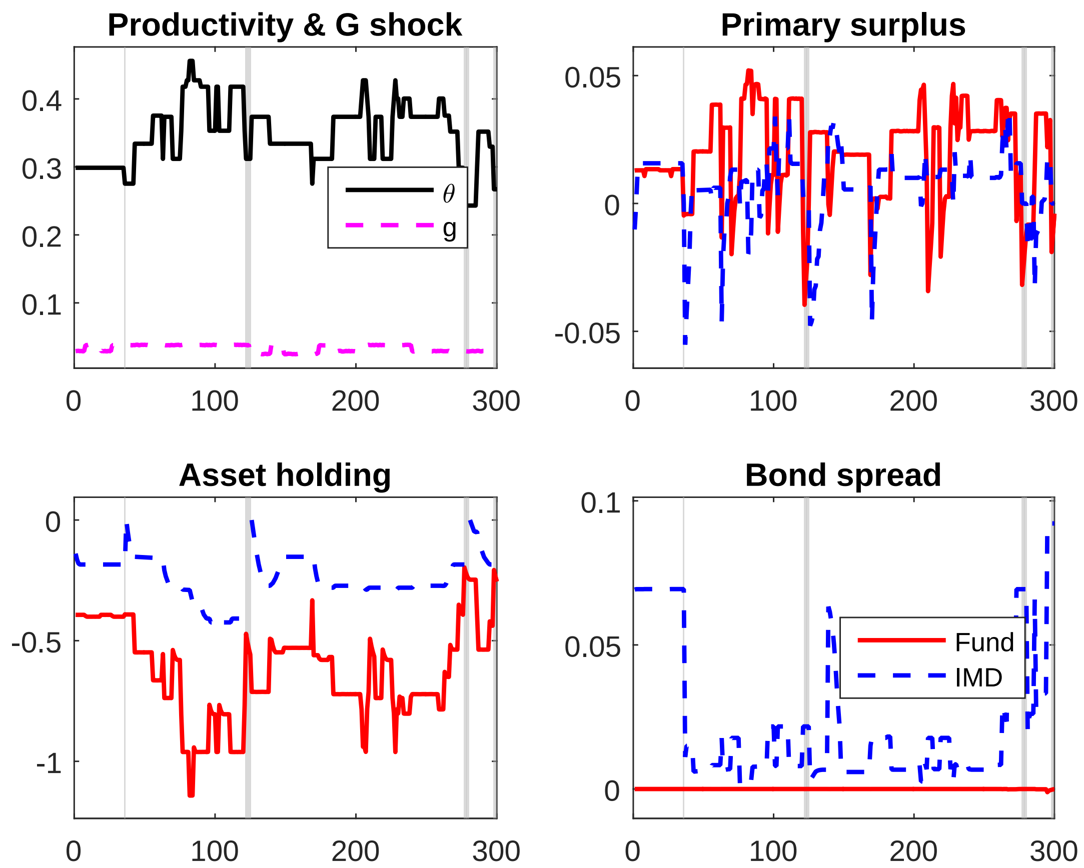
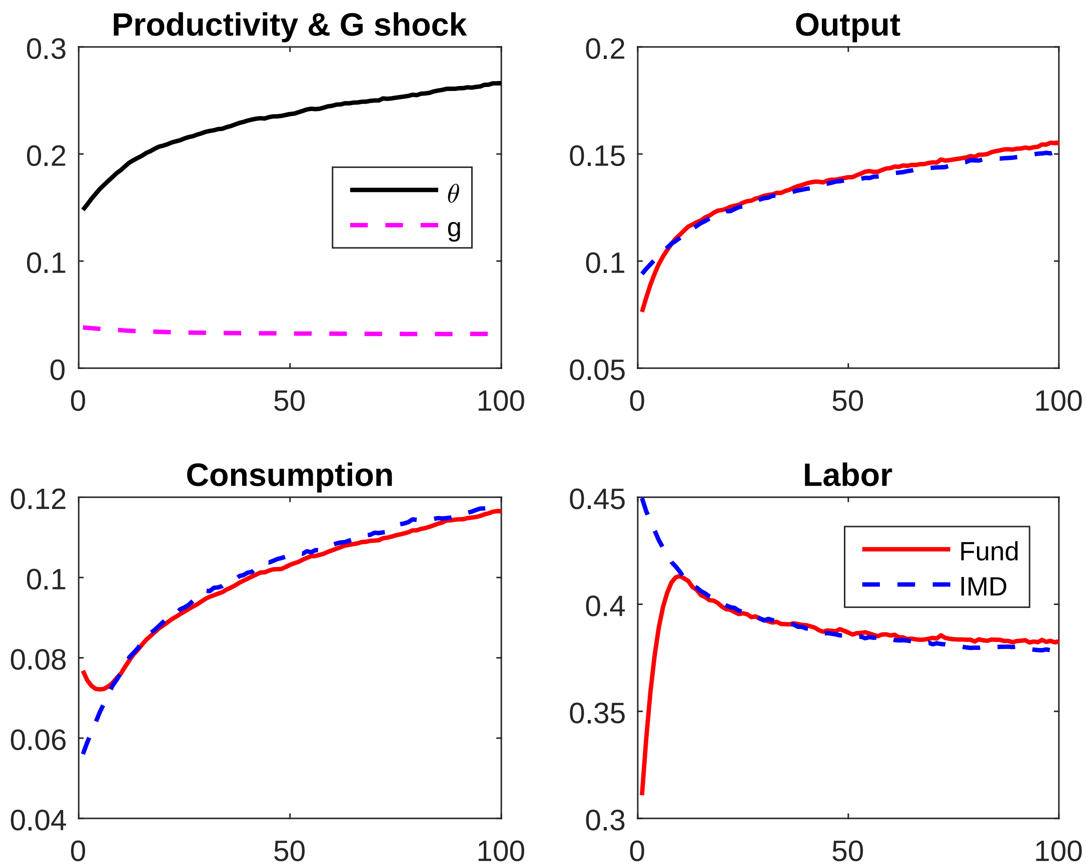


Contrasting paths...

- Repeated defaults [in grey] in the IMD economy, no quits with the Fund.
- Positive spreads 'anticipating' default when debt is relatively high, and just a small episode (at the end) of negative spreads.
- Default episodes mostly driven by productivity shocks: productivity drops + (relatively) large debt levels.
- Larger amount of 'borrowing' with the Fund.
- Primary surpluses tend to be *pro-cyclical* in the IMD economy, *counter-cyclical* with the Fund.
- Smoother consumption and, correspondingly, more volatile asset holdings and primary deficits with the Fund.

Comparing the economies in times of crisis

IMD vs. Fund: combined shock impulse-responses: allocations



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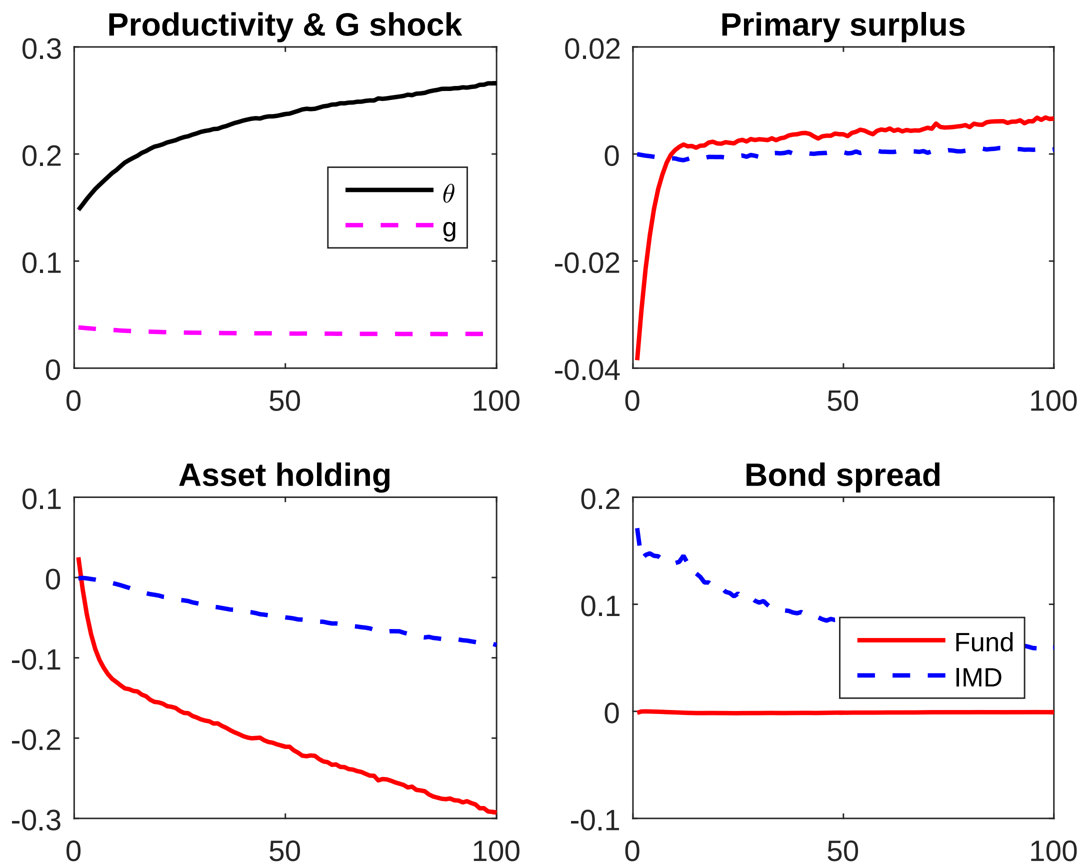


Contrasting a severe crisis...

- With an unexpected ‘one-period’ worst (θ, G) shock the Fund clearly dominates:
  - With a relatively large asset position (implicit insurance) the country can afford higher consumption with lower labor at the beginning (recall that the borrower is relatively more impatient),
  - even if later the asset position becomes negative (debt).
- In contrast, there is a a severe crisis and large spreads with **IMD**!

Contrasting *debt contracts* and *Fund contracts*

- Efficiency, calls for smooth consumption decay (impatience), and labour responding monotonically to productivity.
- The *Fund* achieves these to the extent that *limited enforcement constraints* allow (e.g. they set a lower bound on consumption decay).
- IMD is less efficient; in particular, when borrowers are close to their borrowing/default constraints.
- Fund contracts are able to exploit better the existing asset trading possibilities (e.g. more borrowing with the Fund than with IMD).

Contrasting *debt contracts* and *Fund contracts*

- Persistent crisis and bad shocks exacerbate the differences between debt contracts and fund contracts.

- With the same underlying shocks, **recessions** are likely to be more severe with *incomplete markets*.

- With the same underlying shocks, there can be frequent episodes of **positive spreads and defaults** in the IMD economy, while harmless **negative spreads and no quits** with the Fund.

Welfare gains and absorbing capacity

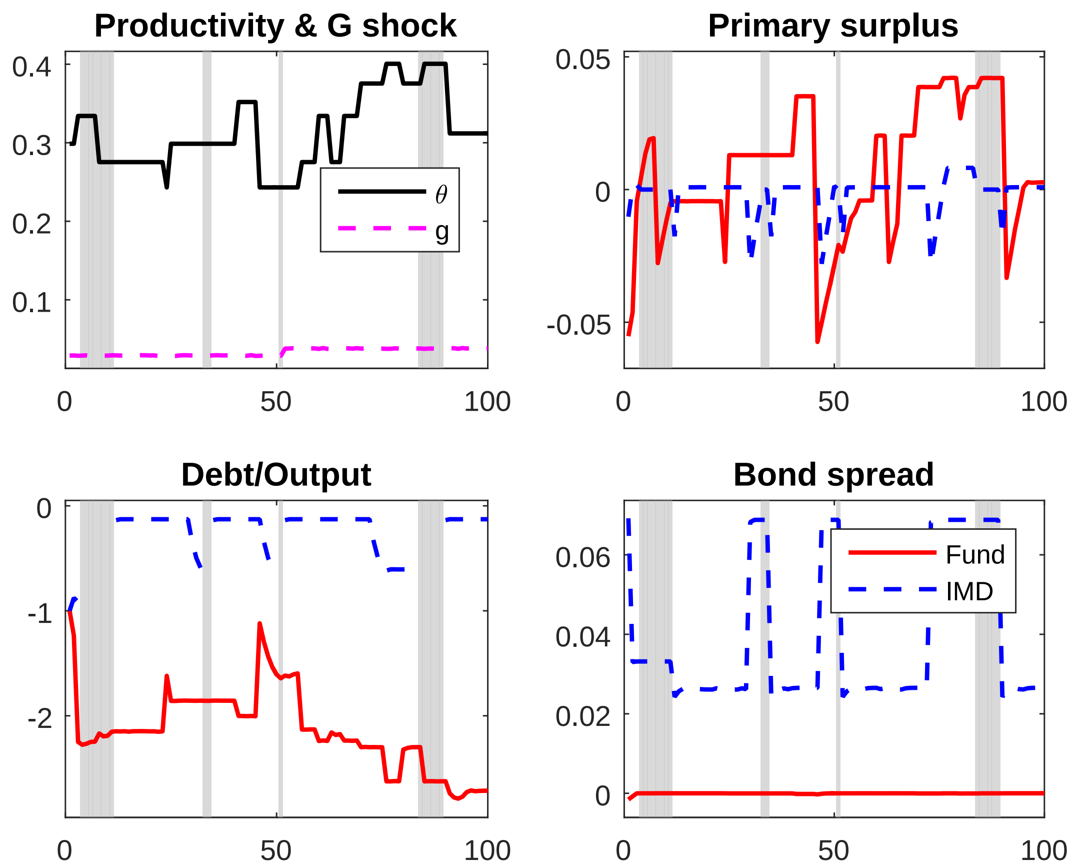
Welfare gains and absorbing capacity

Shocks (θ, G_c)	Welfare Gain	$(b'/y)_{\max}$: M	$(b'/y)_{\max}$: F
$(\theta_l, G_h) = (0.148, 0.038)$	8.90	1.71	97.42
$(\theta_m, G_h) = (0.299, 0.038)$	7.03	107.55	187.16
$(\theta_h, G_h) = (0.456, 0.038)$	4.68	217.43	336.77
$(\theta_l, G_l) = (0.148, 0.025)$	7.87	1.84	101.89
$(\theta_m, G_l) = (0.299, 0.025)$	6.56	111.40	187.93
$(\theta_h, G_l) = (0.456, 0.025)$	4.46	217.80	334.47
Average	**6.53**		

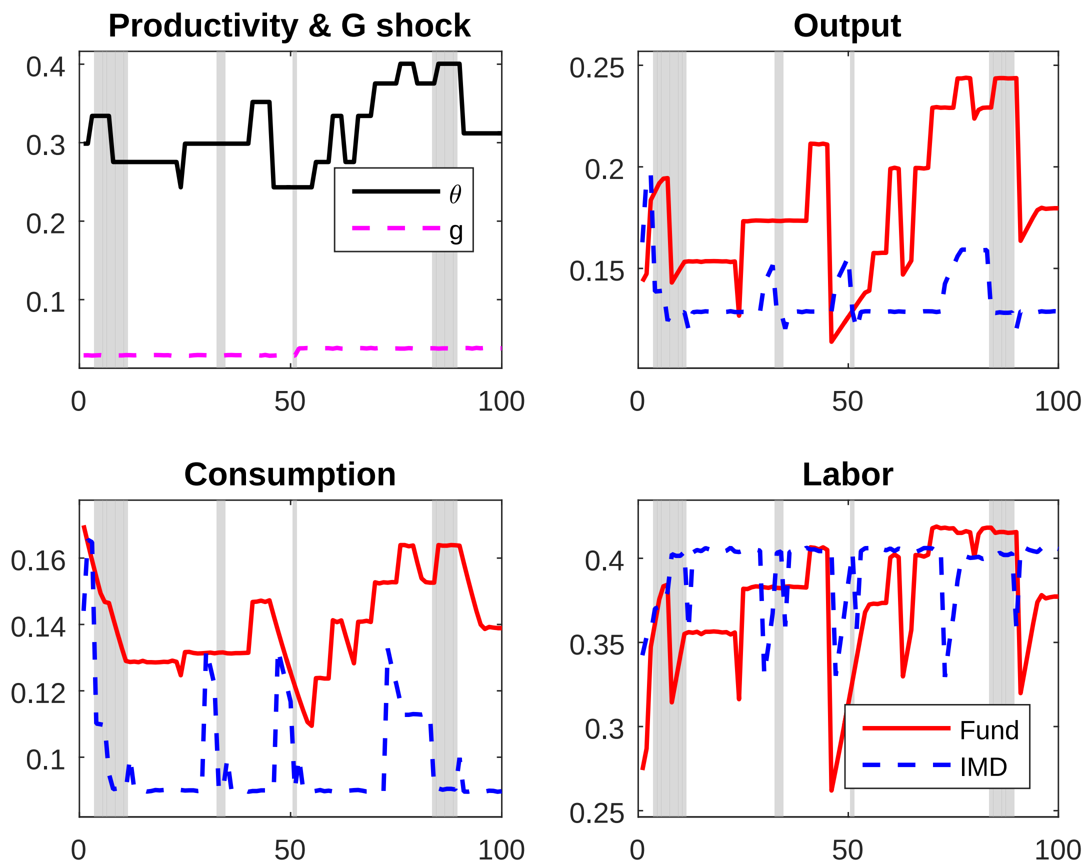
- Welfare gains are expressed in consumption equivalent terms at $b = 0$ (%).
- b^{max} is the maximum level of country indebtedness expressed as the percentage of GDP in a given financial environment (Markets or Fund).

Comparing economies starting with high debt (100% Debt/GDP)

IMD vs. Fund in highly indebted economy: debts and spreads



IMD vs. Fund in highly indebted economy: allocations

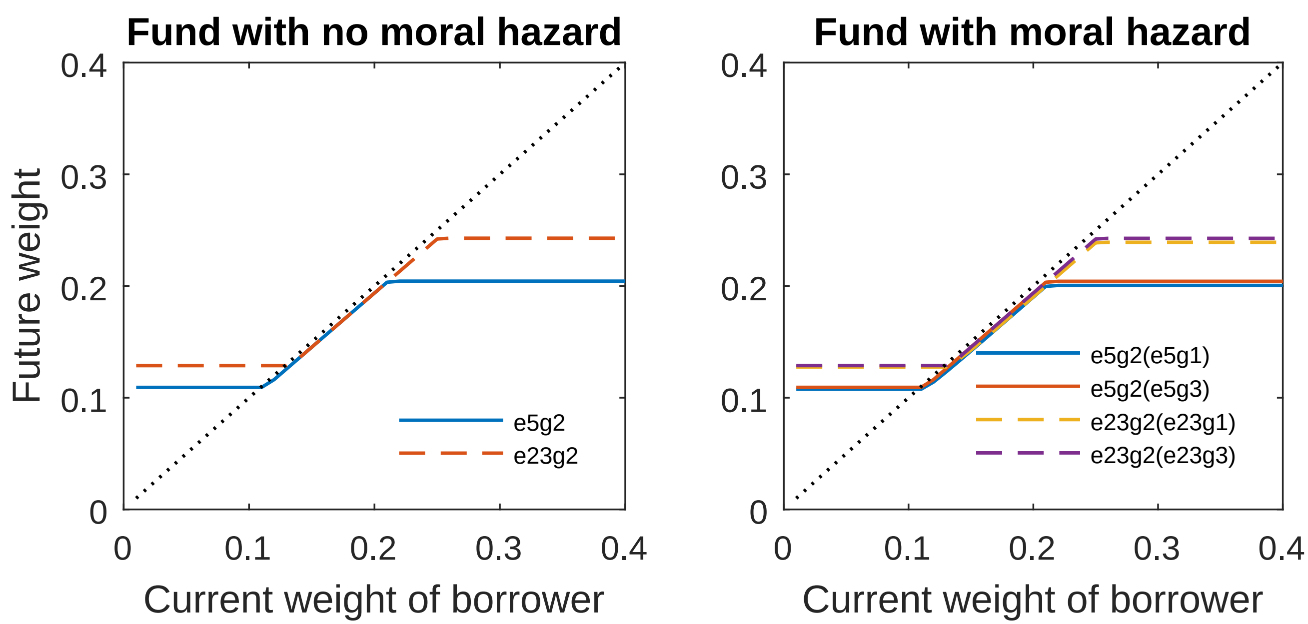


Contrasting paths of highly indebted countries...

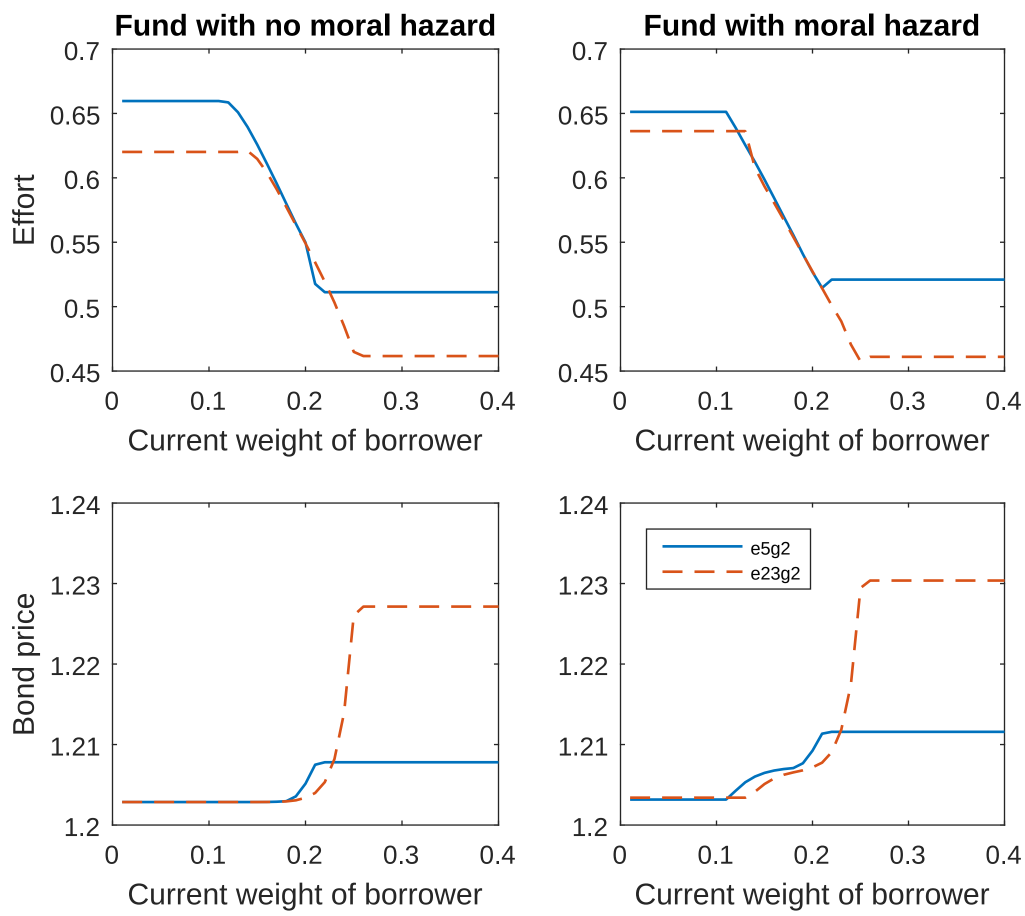
- The debt overhang problem is resolved with **default** in the IMD economy and, in fact, *there is no debt overhang problem*, and **no quits** with the Fund.
- There are Positive spreads 'anticipating' default when debt is relatively high in the IMD economy, and there is a small episode of negative spreads at the beginning with the Fund.
- Larger amount of 'borrowing' with the Fund.

Accounting for **moral hazard** problems

Fund Pareto-weight policies with observable and non-observable endogenous effort



Fund Effort policies and bond prices: observable vs. non-observable effort



Summary

Even with very limited redistribution, the Fund can improve efficiency significantly, with respect to debt financing.

I. The Fund can provide the risk-sharing that it is achieved by taxes & transfers in federal systems.

II. Costly default events may be prevented and severe crises are less likely and/or better handled.

III. The Fund is able to absorb significantly more debt than the markets.

The Fund requires commitment in normal times to avoid time-inconsistency in difficult times. It can also account for **moral hazard** problems without great distortions.

Next Steps

- To simplify the conditionality to help the implementability of the Fund.
- To assess the welfare cost of moral hazard and check whether the market or the fund provide better incentives for prudent policies.
- To show that the Fund can be implemented with *heterogeneous partners*
  $\Longrightarrow$ there is no need to wait 'for economic structures to converge' in order to implement a 'a mechanism of fiscal stabilisation for the euro area as a whole'.
- To contrast the Fund with the current ESM eligibility & conditionality, and with other proposals of 'EA risk-sharing mechanisms' and of 'debt overhang resolution'.
- To address the question: can a market for fund contracts be developed?

There is no future for the EMU, it will involve too much redistribution!

Using dynamic mechanism design, there should be a future for the EMU!

THANKS!