

# 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').
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## I. Risk-sharing in the EMU

“For all economies to be permanently better off inside the euro area, they also need to be able to share the impact of shocks through risk-sharing within the EMU.”  
(*Five Presidents' Report*, 2015).

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# I. Risk-sharing in the EMU

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(*Five Presidents’ Report*, 2015). **How?**

- 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)?
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REFLECTION PAPER ON THE  
**DEEPENING OF THE ECONOMIC  
AND MONETARY UNION**



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## A macroeconomic stabilisation function

The Five Presidents' Report also envisages the creation of a macroeconomic stabilisation function for the euro area.

- ▶ **Key principles.** A common stabilisation function would bring numerous benefits to the euro area. It would complement the national budget stabilisers in the event of severe asymmetric shocks. It would also allow running smoother aggregate fiscal policies for the euro area in unusual circumstances when monetary policy reaches its limits. The guiding principles for such a function, as specified in the Five Presidents' Report, remain valid. The function should not lead to permanent transfers, minimise moral hazard, and not duplicate the role of the European Stability Mechanism (ESM) as crisis management tool. It should be developed within the EU framework and could be open to all EU Member
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## II. Dealing with severe crises

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  - Debt relief with *austerity plans*?  
(Crises becoming recessions?: **Greece has just entered its third recession since 2010!**)
  - A crisis resolution mechanism?
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  - Debt relief with *austerity plans*?  
(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.*
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## III. Resolving debt overhang problems

- by default?
- by debt restructuring? (and further austerity?)
- by transforming sovereign debts into Eurobonds?

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- by default?
  - by debt restructuring? (and further austerity?)
  - 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)
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## **An optimal *Financial Stability Fund***

- As a (constrained) optimal risk-sharing mechanism (I), which can also help with (II) and (III).

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## An optimal *Financial Stability Fund*

- 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'.
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## ***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.

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## The environment

One infinitely-lived risk-averse government with

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

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    - countries smooth shocks, and borrow and lend, with long-term non-contingent debt;
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    - default is costly and the country has no access to international financial markets, temporarily.
  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.
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## 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?
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## *Incomplete markets with default: Long-term Bond*

Following Chatterjee and Eyigungor (2012), a long-term bond is parameterized by  $(\delta, \kappa)$ , where

- $\delta$  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)
- $\kappa$  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

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

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## *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:

$$V_n^b(b, s) = \max_{c, n, e, b'} \left\{ U(c, n, e) + \beta \mathbf{E} \left[ V^b(b', s') \mid s, e \right] \right\}$$
$$\text{s.t. } c + G + q(s, b, b')(b' - \delta b) \leq \theta f(n) + (1 - \delta + \delta \kappa)b,$$

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.

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## *Incomplete markets with default (IMD)*

- The value in autarky is given by

$$V^a(s) = \max_{n,e} \{u(\theta^p(\theta)f(n) - G) + h(1-n) - v(e) \\ + \beta E[(1-\lambda)V^a(s') + \lambda V^b(0, s') \mid s, e]\}$$

- There is a 'default penalty' modelled as a drop in productivity, from  $\theta$  to  $\theta^p$ .
  - After default a government is in autarky, but can re-enter the financial (incomplete) market with probability  $\lambda$ ;  $\lambda$  small.
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## *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:  $d(s, b, b') = \mathbb{E} [D(s', b') \mid s, e^*(s, b)]$
- The price of new debt is:

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

- 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:**  $r^i(s, b, b') - r \geq 0$
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## *Incomplete markets accounting*

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

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

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## 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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  - Transfers are conditional on: *i*) the state of economy, and *ii*) the past history of the agents in the Fund: a single statistic (the relative Pareto weights of the Planner's problem) summarizes the history as a co-state.
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  - We 'price' these contracts as if agents were exchanging *state-contingent assets* subject to endogenous constraints; then histories are summarized by the asset holdings.
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## 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.
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## The Fund contract as long term state-contingent assets

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

$$W^b(a, s) = \max_{(c, n, e, a'(s'))} \left\{ U(c, n, e) + \beta E \left[ W^b(a', s') \mid s \right] \right\}$$
$$\text{s.t. } c + \sum_{s'|s} q(s'|s) (a'(s') - \delta a(s)) \leq \theta(s) f(n) - G(s) + (1 - \delta + \delta \kappa) a(s)$$
$$a'(s') \geq A_b(s')$$

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## The Fund contract as long term state-contingent assets

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

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## The Fund contract as long term state-contingent assets

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

$$W^l(a, s) = \max_{(c, a'(s'))} \left\{ c + \frac{1}{1+r} \mathbb{E} \left[ W^l(a', s') \mid s \right] \right\}$$
$$\text{s.t. } c + \sum_{s'|s} q(s'|s) (a'(s') - \delta a(s)) = (1 - \delta + \delta \kappa) a(s)$$
$$a'(s') \geq A_l(s')$$

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## Fund decentralization

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

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

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

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

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## 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**:  $Z = 0$  !
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## 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:  $\theta_{27} \equiv e_{27}, \dots$ , worst state:  $\theta_1 \equiv e_1$
  - Calibrate the  $G$  shock with a 3-state Markov chain, featuring persistent 'crisis' state:  
Best state:  $G_3 \equiv g_3, \dots$ , worst state:  $G_1 \equiv g_1$
  - Stochastic processes calibrated to the PIIGS countries up to the euro crisis.
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## Model fit

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1 <sup>st</sup> Moments	Data	Model (IMD)
<b>Mean</b>		
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

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$2^{nd}$ Moments	Data	Model (IMD)
<b>Volatility</b>		
$\sigma(C)/\sigma(Y)$	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
$\sigma(\text{real spread})$	1.53%	0.93%
<b>Correlation</b>		
$\rho(C, Y)$	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
$\rho(\text{real spread}, Y)$	-0.35	-0.29
$\rho(G_t, G_{t-1})$	0.94	0.94

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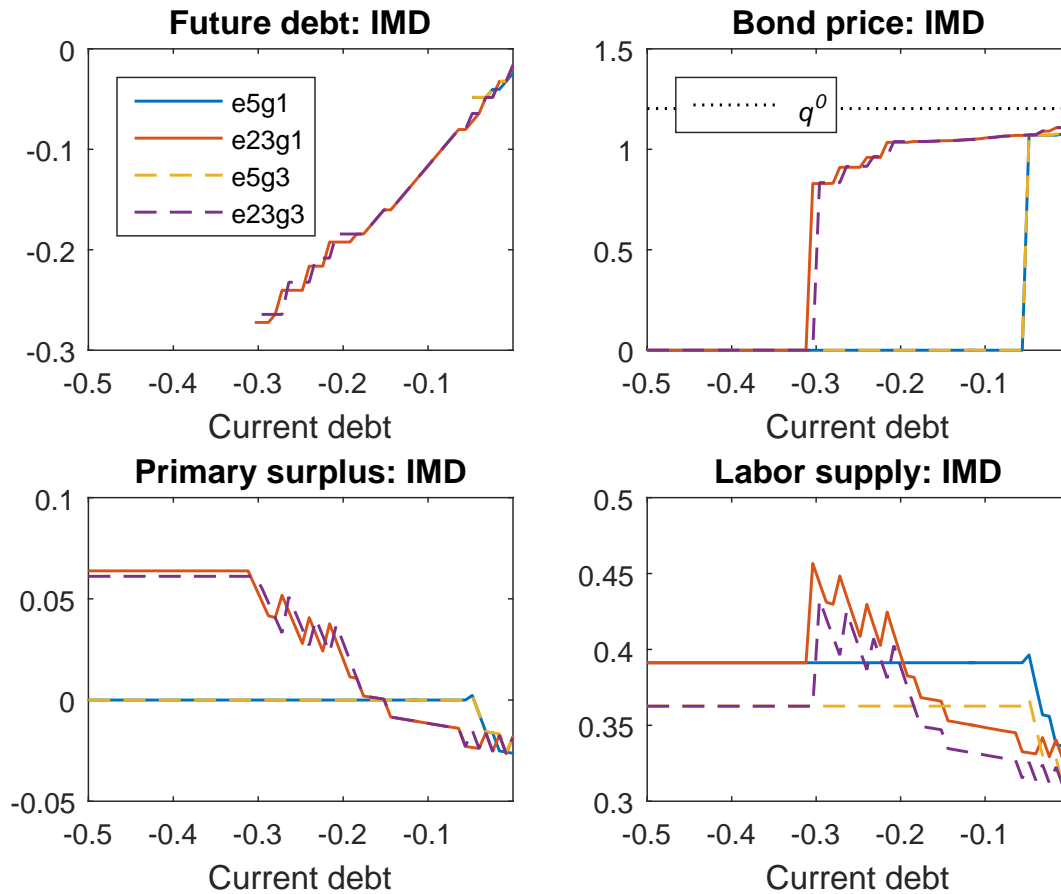
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Optimal policies

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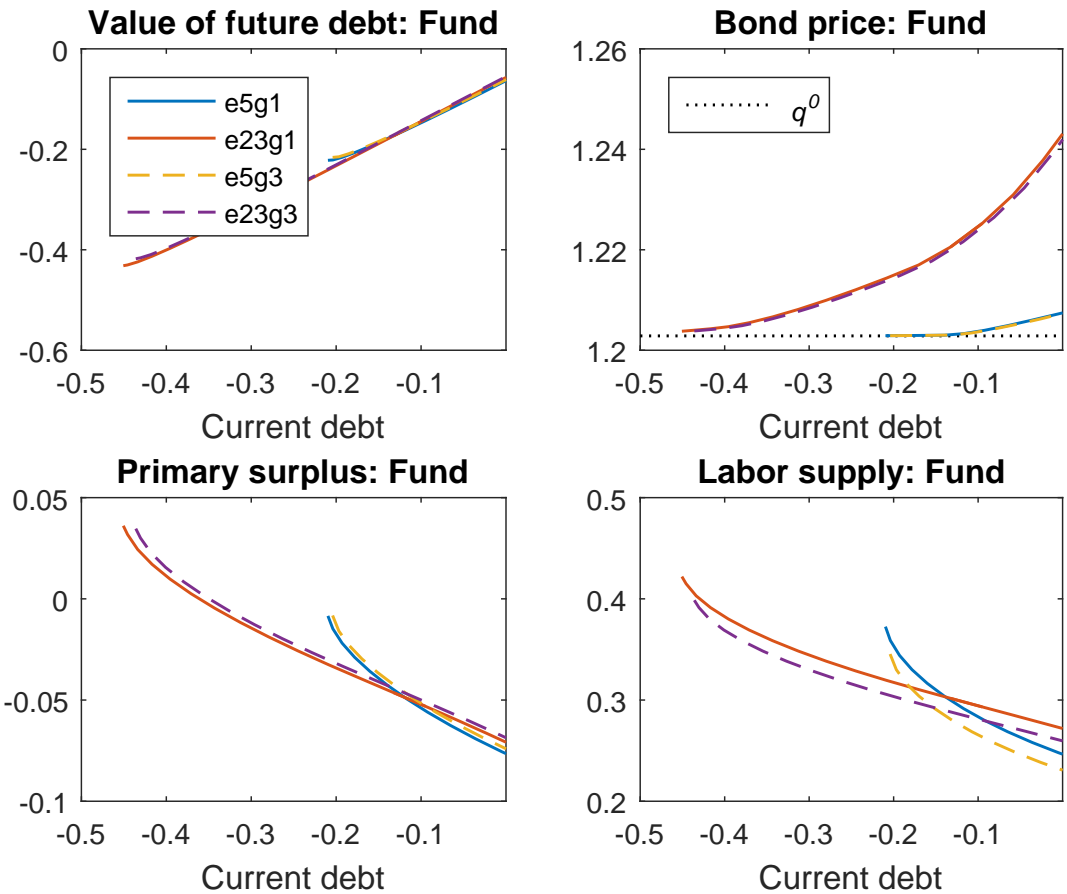
## Optimal policies for incomplete markets with default





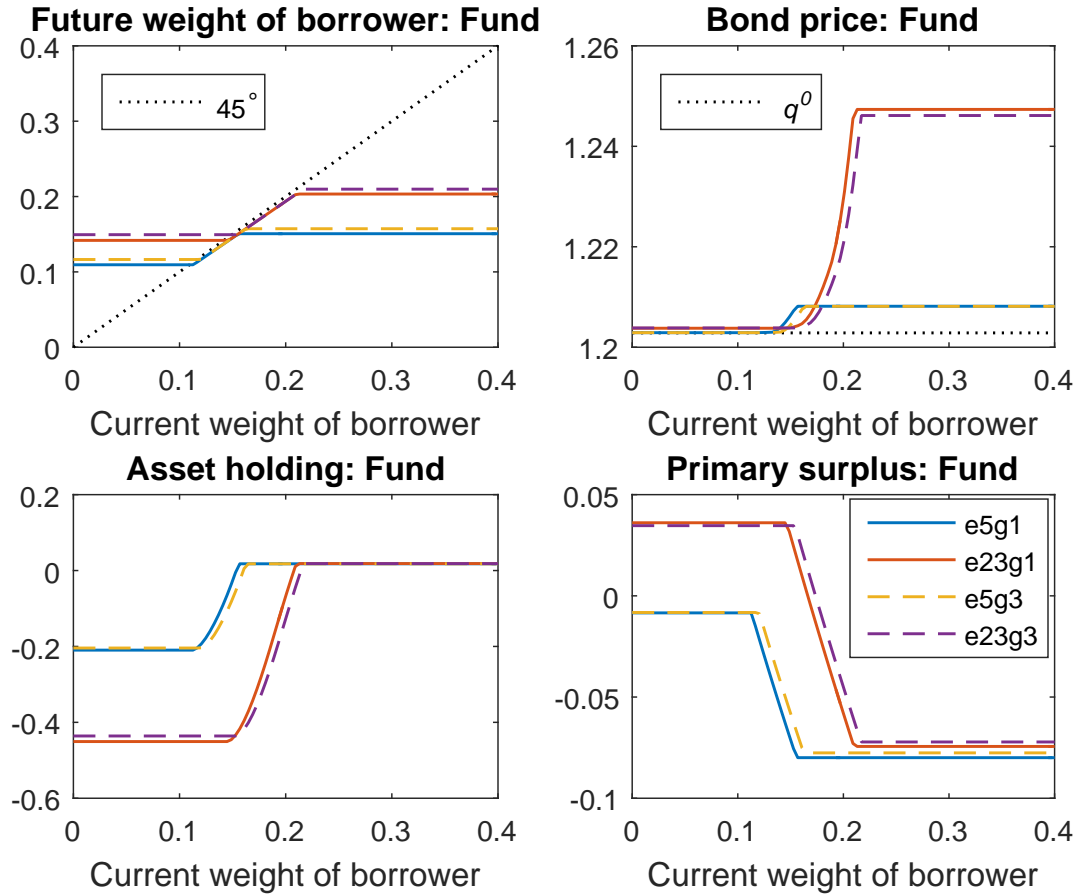
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## Optimal policies for the fund (in assets)



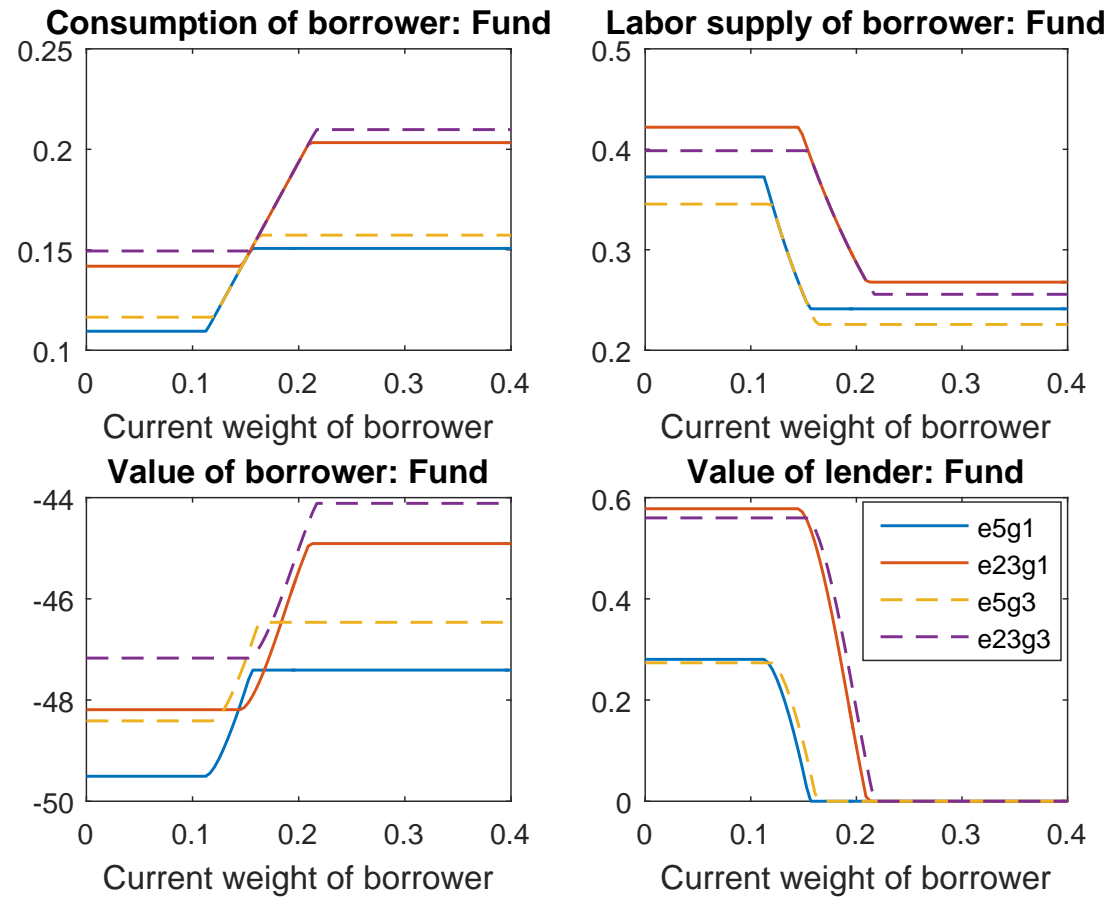
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## Optimal policies for the fund: Pareto weights and assets



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## Optimal policies for the fund: allocations and values



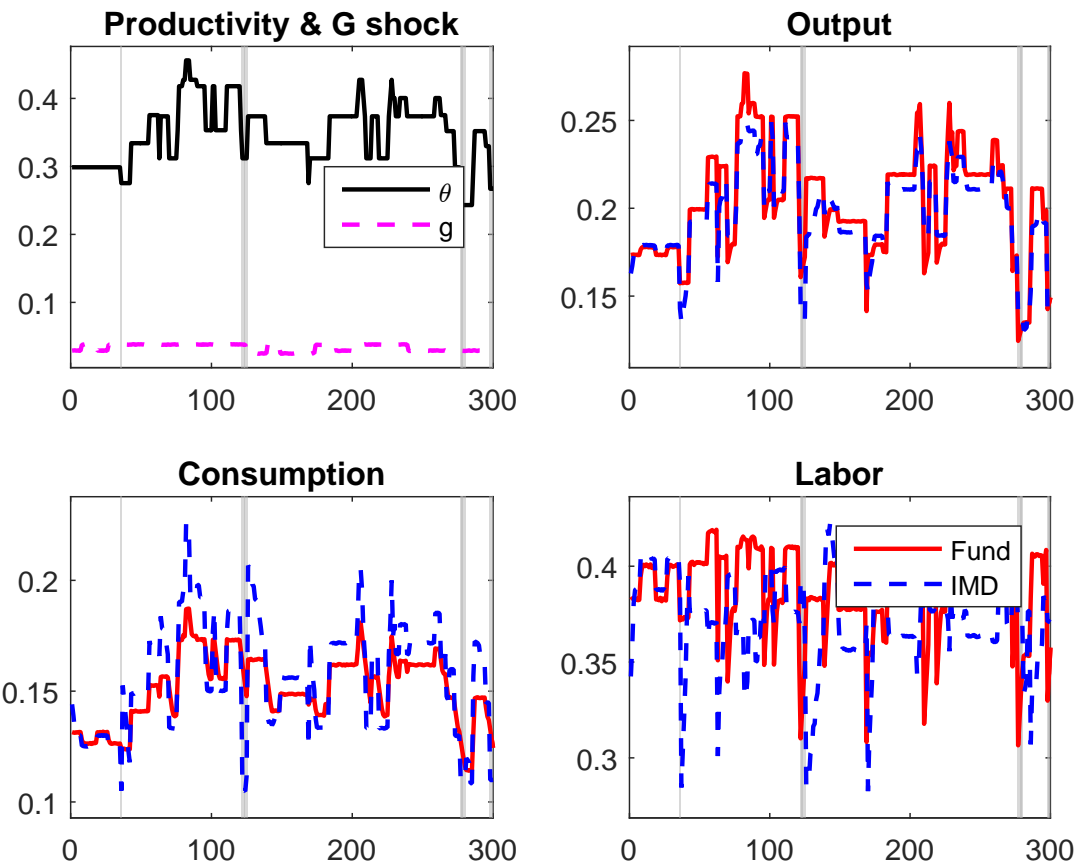
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Comparing the economies in normal times

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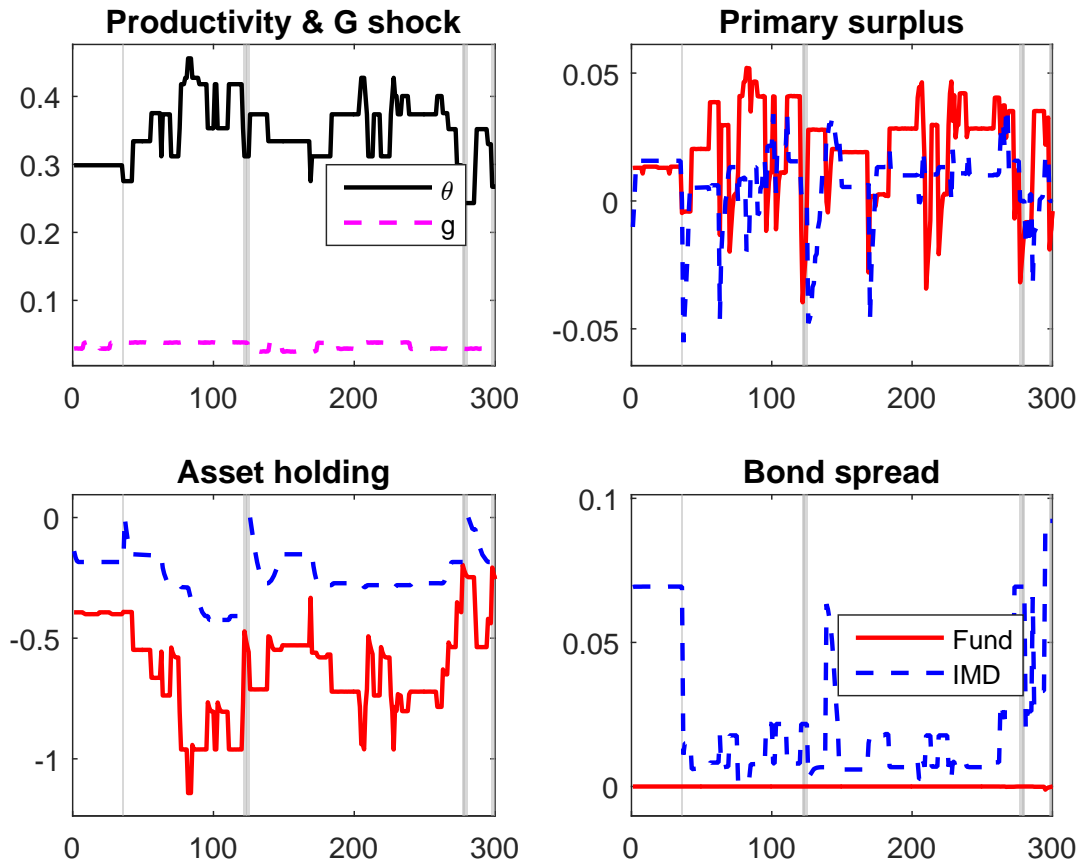
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## IMD vs. Fund Business Cycle Paths: shocks and allocations



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## IMD vs. Fund Business Cycle Paths: shocks and assets



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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**.
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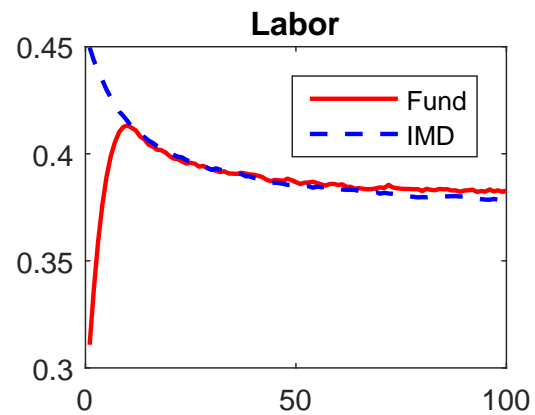
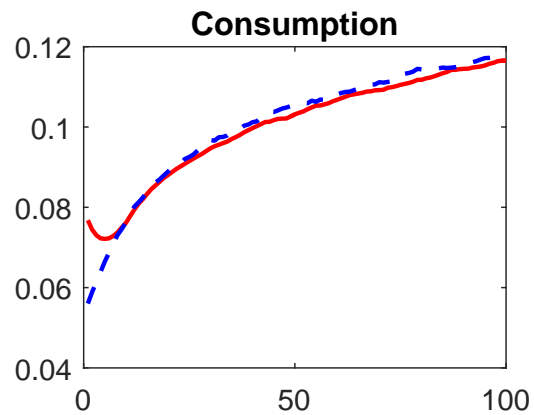
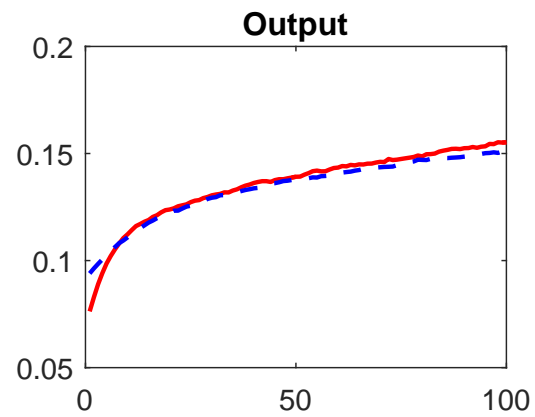
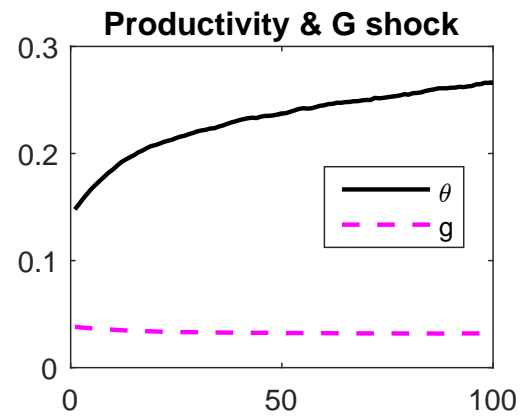
Comparing the economies in times of crisis

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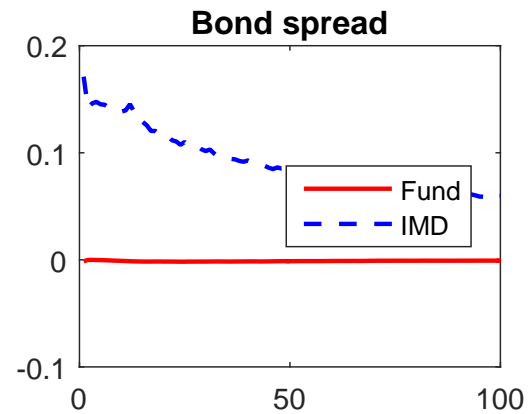
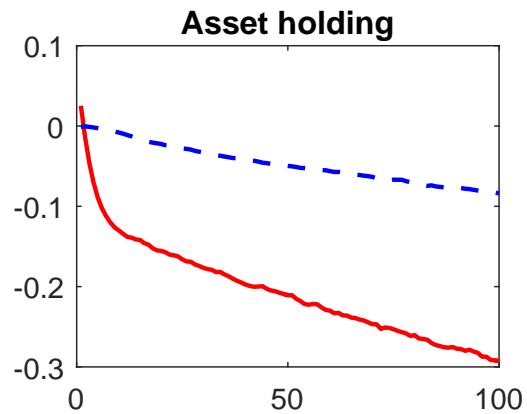
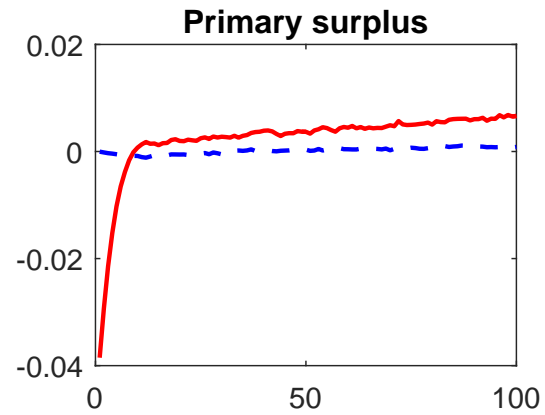
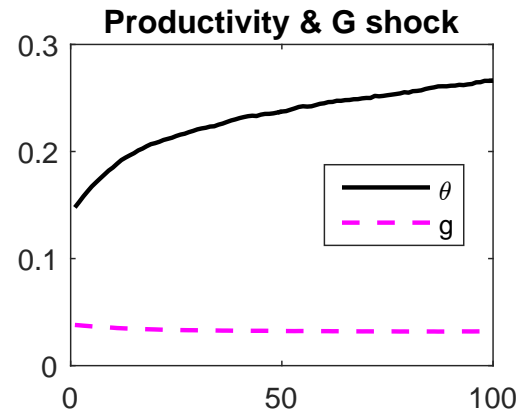
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**IMD vs. Fund: combined shock impulse-responses: allocations**



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**IMD vs. Fund: combined shock impulse-responses: assets**



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## Contrasting a severe crisis...

- With an unexpected 'one-period' worst  $(\theta, G)$  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!**

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## 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*).
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## 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*.
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Welfare gains and absorbing capacity

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## Welfare gains and absorbing capacity

Shocks ( $\theta, G_c$ )	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		

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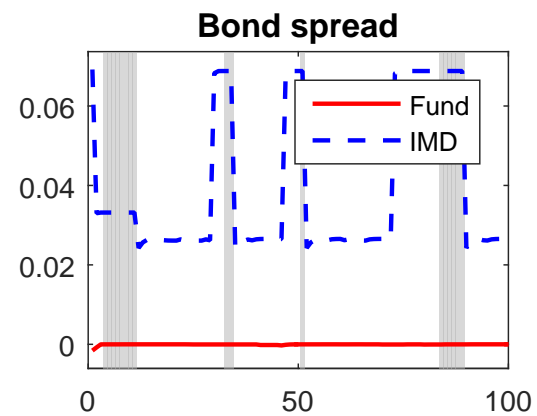
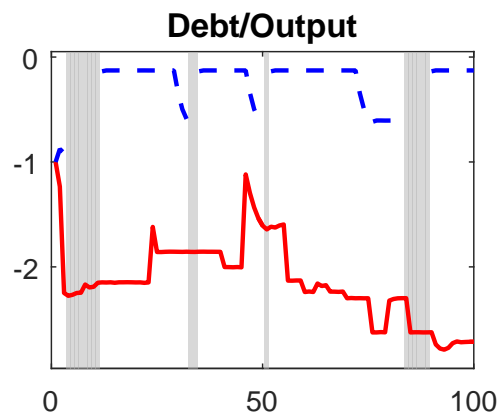
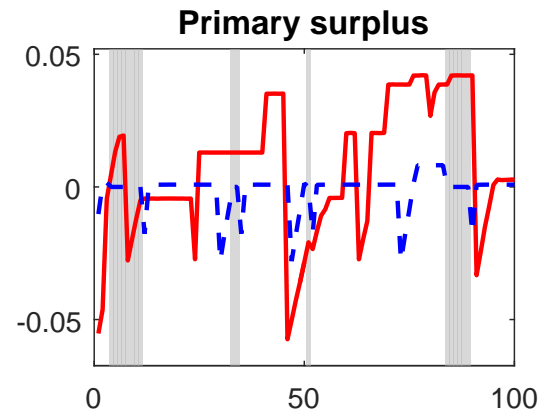
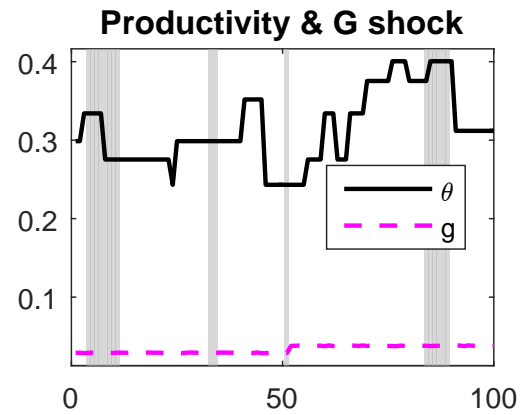
Comparing economies starting with high debt (100% Debt/GDP)

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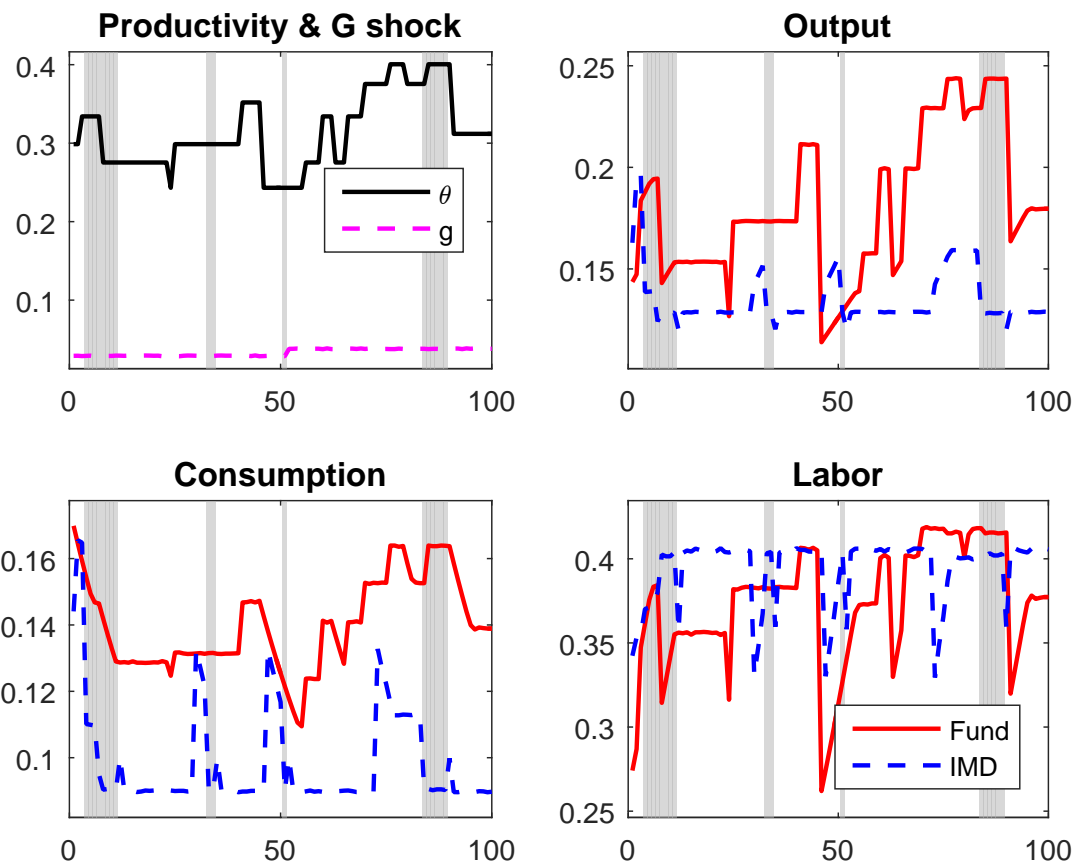
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**IMD** vs. **Fund** in highly indebted economy: debts and spreads



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## IMD vs. Fund in highly indebted economy: allocations



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## 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**.
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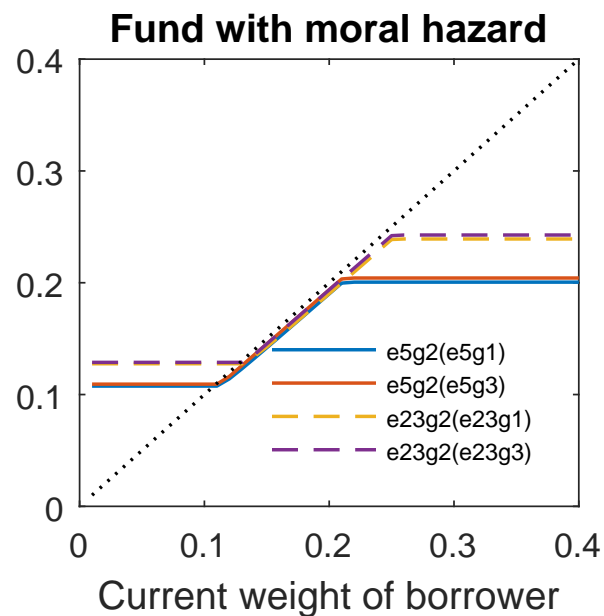
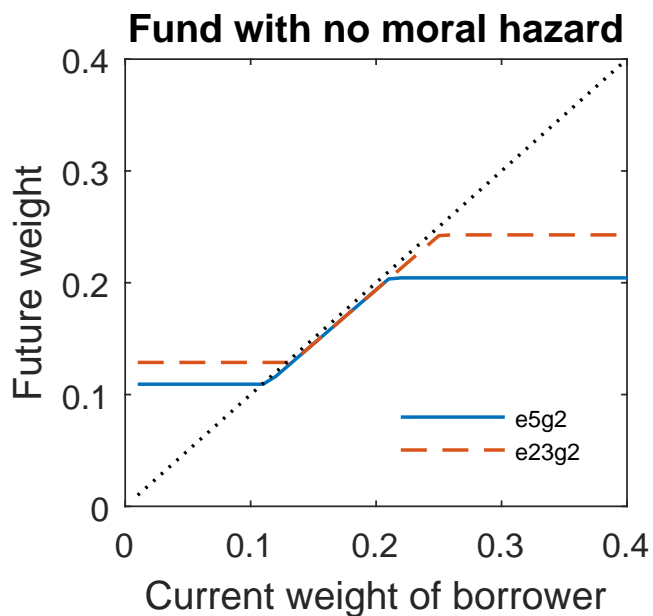
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## Accounting for **moral hazard** problems

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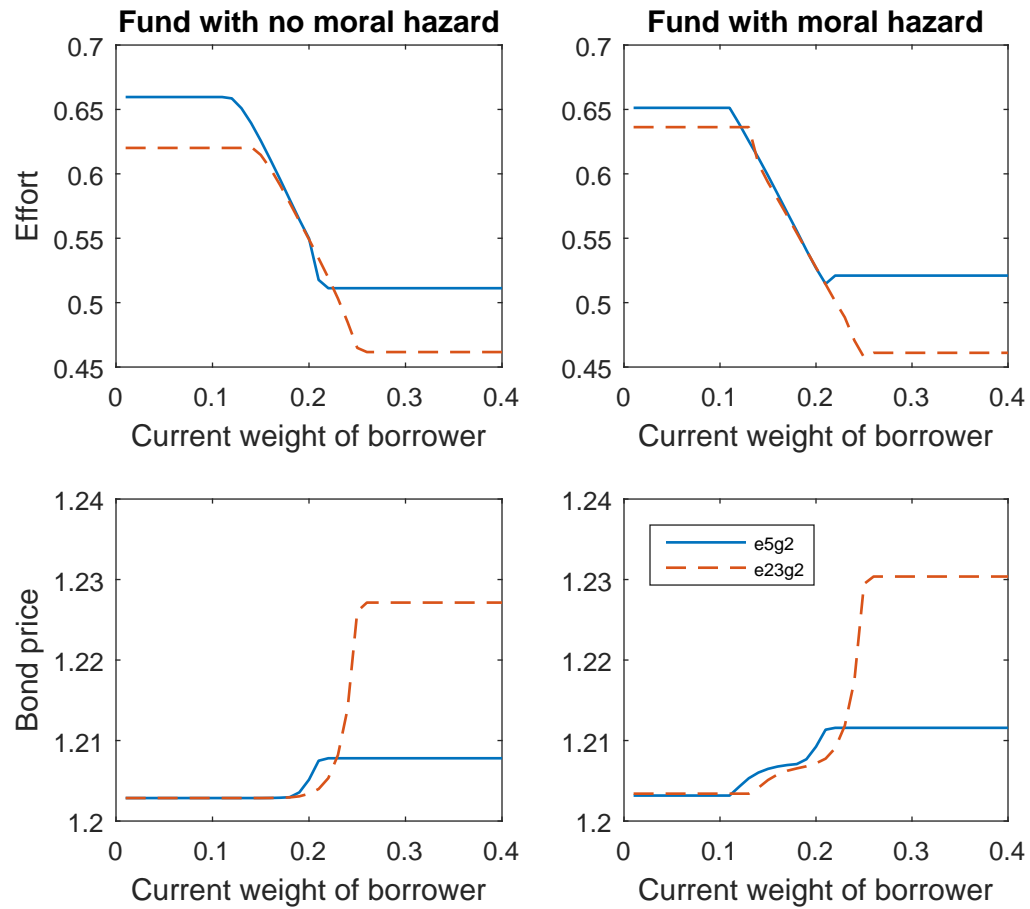
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**Fund** Pareto-weight policies with observable and non-observable endogenous effort



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



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## 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.

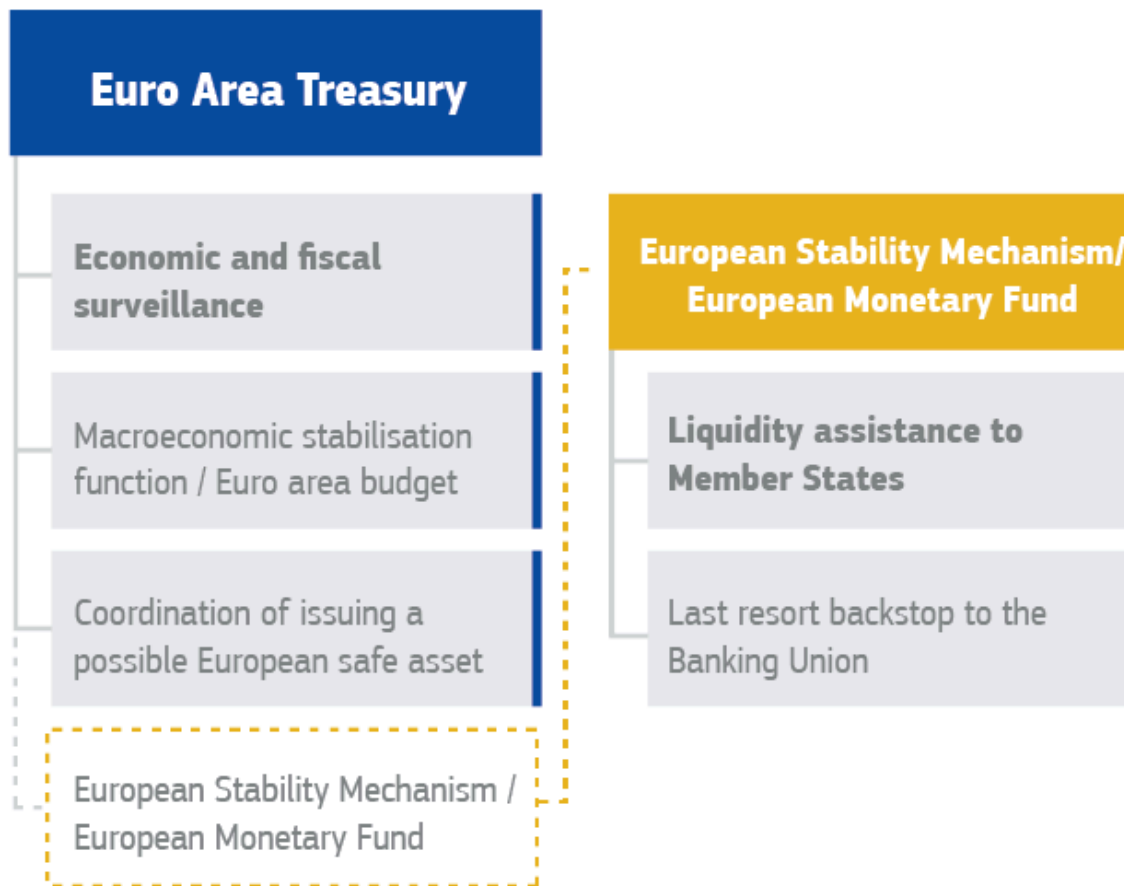
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# The European Monetary Fund ?

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Source: European Commission

31 May 2017

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# ADEMU

**A Dynamic Economic and Monetary Union**



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**THANKS!**

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