On the optimal design of a
Financial Stability Fund

Árpád Ábrahám*       Eva Carceles-Poveda†       Yan Liu‡
Ramon Marimon§

European Economic Association Meeting
Toulouse, August 29, 2014

*European University Institute
†SUNY at Stony Brook
‡Wuhan University
§European University Institute, UPF - Barcelona GSE, CEPR and NBER
Looking at the Euro crisis...
November 2012:

Greece waiting for the bailout cash
Long-term spreads over German bond
Primary deficit & surplus /GDP
(MA 2000Q2 – 2011Q2 source ECB)
The EU lost decade?
(Cooley-Rupert European Economic Snapshot)

Real Gross Domestic Product

Quarters from Peak
The PIIGS lost decade?
The Euro policy responses I

- Maintain ECB mandate of price stability
- The indebted Euro countries keep using debt-financing (with very costly roll-overs)
- In spite of the “no-bailout clause” in the EU Treaty (Art. 125), a country’s default is perceived catastrophic (bail-out, or partial-bailout expectations)
- Rescue Packages (with IMF): Greece, Ireland and Portugal & Cyprus, Spain’s banks,... IMF style: conditional (austerity) financial support (with Greece reschedule)
Long-term spreads over German bond

Greece Debt Rescheduling February 2012
June 2012
Greece 26.3

Portugal (€78b) May 2011
June 2012
Portugal 10.52

Spain 7.16
June 2012
(€100b)

Ireland (€67.5b) November 2010
June 2012
Ireland 8.27

Greece (€110b) May 2010
The Euro policy responses II

- In spite of the "monetary financing prohibition" (Art. 123), large ECB debt purchase interventions.

- From discretion and secrecy to rules and transparency? (from secret letters to Italy and Spain to *Outright Monetary Transactions* ECB mechanism and 2014 *QE* programmes.

- The European Fiscal Compact (2 March, 2012) setting deficit constraints in State constitutions (similar to US States)

- The creation of the European Stability Mechanism (Spain’s Bank Rescue its ‘first success’, already in 2013)

- Towards a genuine Economic and Monetary Union? (H. van Rompuy, 2012)
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.
December 5, 2012

The Van Rompuy Report:

“The euro area needs stronger mechanisms to ensure sound national policies so that Member States can reap the full benefits of the EMU. This is essential to ensure trust in the effectiveness of European and national policies, to fulfill vital public functions, such as stabilisation of economies and banking systems, to protect citizens from the effects of unsound economic and fiscal policies, and to ensure high level of growth and social welfare.”

“An EMU fiscal capacity with a limited asymmetric shock absorption function could take the form of an insurance-type system between euro area countries. Contributions from, and disbursements to, national budgets would fluctuate according to each country’s position over the economic cycle.”
A Financial Stability Fund as a Dynamic Mechanism Design problem

- The finance theories on the ‘optimality of the debt contract’ do not apply to the long-term relationship of countries in an Economic Union.

- Long-term contracts can provide risk-sharing and enhance borrowing & lending and investment opportunities.

- A FSF can either use only its own financial resources, or also act as a maturity transformation facility, transforming non-contingent loans (from international markets, Central Banks, or households) into contingent loans to participants in the FSF.
A Financial Stability Fund as a Dynamic Mechanism Design problem

However, a well designed FSF must take into account:

**The redistribution, or Hayek’s, problem:** the *participation constraints* of all the FSF members (and the FSF as lender)

**The moral hazard problem:** the *incentive compatibility constraints* (not accounted for in this version)
The environment

• One risk-averse government-borrower & one risk-neutral fund-lender

• Lender: at the risk-free rate $r$

• Borrower’s technology: leisure, $l = 1 - n$ & output, $y = \theta f(n)$

• Borrower’s preferences: $U(c, n) \equiv u(c) + h(1 - n) & \beta$, $1/(1 + r) \geq \beta$

• Markovian shocks: productivity, $\theta$ & government expenditure, $G$; i.e. an exogenous state $s = (\theta, G)$, with transition probability $\pi(s'|s)$. 
Two alternative borrowing & lending mechanisms

• *Incomplete markets* with default (*IMD*)

• *Financial Stability Fund* (*FSF*) with two-sided limited commitment (*2S*)

• How would an *IMD* look if, with the same shocks, had a *2S − FSF*? (Greece with a proper *FSF*)

• How much would it gain?
Incomplete markets with default.

Following Arellano (2008), if the country does not default on its debt, the value of $b$ at $s$ is:

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

s.t. $c + G + q(s, b')b' \leq \theta f(n) + b,$

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

$$V^{bia}(b, s) = \max \{ V^{bid}(b, s), V^{ai}(b, s) \}$$

$b = \text{asset holdings}$ at the beginning of the period (if $b < 0$ we call it debt)
Incomplete markets with default.

- The value in autarky is given by

\[ V^{ai}(s) = \max_n \{ U((\theta^p f(n) - G, n) \]

\[ + \beta E \left[ (1 - \lambda) V^{ai}(s') + \lambda V^{bid}(0, s') \mid s \right] \}

- There is a ‘default penalty’ modelled as a drop in productivity, from \( \theta \) to \( \theta^p \) (Arellano’s trick).

- After default a government is in autarky, but can be re-enter the financial (incomplete) market with probability \( \lambda \); \( \lambda \) small.
**Incomplete markets with default**

- The choice of default:
  \[ D(s, b) = 1 \text{ if } V^{ai}(s) > V^{bid}(b, s) \text{ and } 0 \text{ otherwise}, \]

- The price of new debt:
  \[ q(s, b') = \frac{1 - d(s, b')}{1 + r} \]

- The expected default rate:
  \[ d(s, b') = \mathbb{E}[D(s', b') | s] \]

- The debt interest rate:
  \[ r^i(s, b') = \frac{1}{q(s, b')} - 1 \]

- The ‘positive spread’:
  \[ r^i(s, b') - r \geq 0 \]
Incomplete markets accounting

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

\[
q(s, b')b' - b = \theta f(n) - (c + G')
\]
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, $V^{af}(s_t)$, is defined as $V^{ai}(s_t)$, except that in this case, $\lambda = 0$; i.e. there is no return to the fund.

- $Z \leq 0$ is the ex-post outside value of the lender.

- Notation: $s^t = (s_0, \ldots, s_t)$. 
The Financial Stability Fund as a long-term contract

\[
\begin{align*}
\max_{\{c(s^t), n(s^t)\}} & \quad \mathbb{E} \left[ \mu_{b,0} \sum_{t=0}^{\infty} \beta^t \left[ U(c(s^t), n(s^t)) \right] + \mu_{l,0} \sum_{t=0}^{\infty} \left( \frac{1}{1 + r} \right)^t \tau(s^t) \mid s_0 \right] \\
\text{s.t.} & \quad \mathbb{E} \left[ \sum_{r=t}^{\infty} \beta^{r-t} \left[ U(c(s^r), n(s^r)) \right] \mid s^t \right] \geq V^{af}(s_t), \\
& \quad \mathbb{E} \left[ \sum_{r=t}^{\infty} \left( \frac{1}{1 + r} \right)^{r-t} \tau(s^r) \mid s^t \right] \geq Z, \\
\text{and} & \quad \tau(s^t) = \theta(s^t)f\left(n(s^t)\right) - c(s^t) - G(s^t), \ \forall s^t, t \geq 0.
\end{align*}
\]
The Financial Stability Fund as a long-term contract

**2S** A two-sided limited enforcement contract, when both participation constraints may bind, for \( t > 0 \).

**FB** A first best contract, when \( V^a_f (s_t) \) and \( Z \) are never binding, for \( t > 0 \).
The **Financial Stability Fund** as a long-term contract

Following Marcet & Marimon (1999, 2011), we can write the FSF contracting problem as:

\[
\min_{\{\gamma_{b,t}, \gamma_{l,t}\}} \max_{\{c_t, n_t\}} \mathbb{E} \left[ \sum_{t=0}^{\infty} \beta^t \left( \mu_{b,t+1}(s^t)U(c(s^t), n(s^t)) - \gamma_{b,t}(s^t)V^A(s_t) \right) + \sum_{t=0}^{\infty} \left( \frac{1}{1 + r} \right)^t \left( \mu_{l,t+1}(s^t)\tau(s^t) - \gamma_{l,t}(s^t)Z \right) \mid s_0 \right] \]

\[
\mu_{i,t+1}(s^t) = \mu_{i,t}(s^{t-1}) + \gamma_{i,t}(s^t), \mu_{i,0}(s_0) \text{ is given, for } i = b, l,
\]

where \(\gamma_{i,t}(s^t)\) is the Lagrange multiplier of the participation constraint of agent \(i\) in period \(t\), state \(s^t\), and \(\mu_{i,0}(s^{t-1}) = \mu_{i,0}\).
The Financial Stability Fund as a long-term contract

Following Kehoe and Perri (2002), we can use as co-state variable $x_t = \frac{\mu_l,t}{\mu_{b,t}\eta}$, where $\eta \equiv \beta(1 + r) \leq 1$, and $v_i(x, s) = \gamma_i(x, s) / \mu_i(x, s)$, $i = b, l$.

Resulting in policy functions $c(x, s)$, $n(x, s)$, $\tau(x, s)$ and $v_b(x, s)$, $v_l(x, s)$, satisfying

$$u'(c(x, s)) = x' = \frac{1 + v_l(x, s)x}{1 + v_b(x, s)\eta},$$

and

$$\frac{h'(1 - n(x, s))}{u'(c(x, s))} = \theta f'(n(x, s)).$$
The Financial Stability Fund as a long-term contract

The value function of the FSF contracting problem takes the form:

\[ FV(x, s) = xV^{lf}(x, s) + V^{bf}(x, s); \text{ where,} \]

\[ V^{bf}(x, s) = U(c(x, s), n(x, s)) + \beta \mathbb{E} \left[ V^{bf}(x', s') \mid s \right] \]

and

\[ V^{lf}(x, s) = \tau(x, s) + \frac{1}{1 + r} \mathbb{E} \left[ V^{lf}(x', s') \mid s \right] \]

Furthermore, \( V^{bf}(x, s) \geq V^{af}(s) \), with equality if \( v_b(x, s) > 0 \) and, similarly, \( V^{lf}(x, s) \geq Z \) with equality if \( v_l(x, s) > 0 \).
Decentralizing the *FSF contract*

Following Alvarez and Jermann (2000), we can find competitive prices to value *FSF* contracts and compare them with the *IM* and *IMD* contracts.
The dual competitive economy

Let the borrower have access to a complete set of one-period Arrow securities...

\[
\max \left\{ c_b(s^t), n(s^t), a_b(s^{t+1}) \right\} \sum_{t=0}^{\infty} \sum_{s^t} \beta^t \pi \left( s^t \right) U(c_b(s^t), n(s^t)) \\
\text{s.t. } c_b(s^t) + \sum_{s^{t+1}|s^t} q(s^{t+1}|s^t) a_b(s^{t+1}) = \theta(s^t) f(n(s^t)) - G(s^t) + a_b(s^t) \\
a_b(s^{t+1}) \geq A_b(s^{t+1})
\]

- \( q(s^{t+1}|s^t) \) is the price of the one-period state contingent assets
- \( a_b(s^{t+1}) \) are the asset (contingent claims) holdings
- \( A_b(s^{t+1}) \) is an endogenous borrowing limit
The dual competitive economy

The borrower’s choice satisfies

\[ q \left( s^{t+1} \mid s^t \right) \geq \beta^t \pi \left( s^{t+1} \mid s^t \right) \frac{u' \left( c_b \left( s^{t+1} \right) \right)}{u' \left( c_b \left( s^t \right) \right)} \]

with equality if \( a_b \left( s^{t+1} \right) > A_b \left( s^{t+1} \right) \), as well as the present-value budget constraint.
The dual competitive economy

Similarly, let the lender have access to a complete set of Arrow securities...

\[
\begin{align*}
\max_{\{c_l(s^t), a_l(s^{t+1})\}} \sum_{t=0} \sum_{s^t} \left( \frac{1}{1 + r} \right)^t \pi(s^t) c_l(s^t) \\
\text{s.t. } c_l(s^t) + \sum_{s^{t+1}|s^t} q(s^{t+1}|s^t) a_l(s^{t+1}) &= a_l(s^t) \\
a_l(s^{t+1}) &\geq A_l(s^{t+1})
\end{align*}
\]

The lender’s choice satisfies, with equality if \(a_l(s^{t+1}) > A_l(s^{t+1})\),

\[
q(s^{t+1}|s^t) \geq \left( \frac{1}{1 + r} \right)^t \pi(s^{t+1}|s^t)
\]
The decentralized FSF contract

Let \( \{ c^* (s^t) , n^* (s^t) , \tau^* (s^t) \} \) be the allocation of a FSF contract...

\[
q^* (s^{t+1}|s^t) = \max \left\{ \beta \pi (s_{t+1}|s_t) \frac{u'(c^* (s^{t+1}))}{u'(c^* (s^t))}, \left( \frac{1}{1+r} \right) \pi (s^{t+1}|s^t) \right\}
\]

\[
= \left( \frac{1}{1+r} \right) \pi (s_{t+1}|s_t) \max \left\{ \frac{1 + v_l(x_{t+1}, s_{t+1})}{1 + v_b(x_{t+1}, s_{t+1})}, 1 \right\}
\]

- If the lender’s participation constraint is not binding: \( \frac{1 + v_l(x_{t+1}, s_{t+1})}{1 + v_b(x_{t+1}, s_{t+1})} \leq 1 \).
The decentralized FSF contract

Let \{c^*(s^t), n^*(s^t), \tau^*(s^t)\} be the allocation of a FSF contract...

\[
q^*(s^{t+1}|s^t) = \max \left\{ \beta \pi(s_{t+1}|s_t) \frac{u'(c^*(s^{t+1}))}{u'(c^*(s^t))}, \left(\frac{1}{1 + r}\right) \pi(s^{t+1}|s^t) \right\} \\
= \left(\frac{1}{1 + r}\right) \pi(s_{t+1}|s_t) \max \left\{ \frac{1 + v_l(x_{t+1}, s_{t+1})}{1 + v_b(x_{t+1}, s_{t+1})}, 1 \right\}
\]

- If the lender’s participation constraint is not binding: \(\frac{1 + v_l(x_{t+1}, s_{t+1})}{1 + v_b(x_{t+1}, s_{t+1})} \leq 1\).
- Since the price of a one-period bond: \(q^f(s^t) = \sum_{s^{t+1}|s^t} q^*(s^{t+1}|s^t)\),
- when the lender’s participation constraint is binding, for some \(s^{t+1}\), the ‘spread can be negative’: \(r^i(s^t) - r \leq 0\).
- In which case, the FSF does not lend beyond the current level to the ‘borrowing’ country...
  (Asset prices implement the lender’s participation constraint).
The dual competitive economy

The values for the borrower and the lender have a recursive form

\[ W^b(a_b, s) = U(c(a_b, s), n(a_b, s)) + \beta E\left[ W^b(a'_b, s') \mid s \right] \]

and

\[ W^l(a_l, s) = \tau(a_l, s) + \frac{1}{1 + r} E\left[ W^l(a'_l, s') \mid s \right] \]
The dual competitive economy

The values for the borrower and the lender have a recursive form

\[ W^b(a_b, s) = U(c(a_b, s), n(a_b, s)) + \beta E \left[ W^b(a_b', s') | s \right] \]

and

\[ W^l(a_l, s) = \tau(a_l, s) + \frac{1}{1 + r} E \left[ W^l(a_l', s') | s \right]. \]

Mirror of

\[ V^{bf}(x, s) = U(c(x, s), n(x, s)) + \beta E \left[ V^{bf}(x', s') | s \right] \]

and

\[ V^{lf}(x, s) = \tau(x, s) + \frac{1}{1 + r} E \left[ V^{lf}(x', s') | s \right] \]

with \( a_l(s^t) = -a_b(s^t) \).
The decentralized FSF contract

The borrowing limits satisfy

\[ W^b(A_b(s^t), s^t) = V^{af}(s^t) \]

\[ W^l(A_l(s^t), s^t) = Z \]
**FSF accounting**

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

$$\sum_{s'|s} q(s'|s) a_b(s') - a_b(s) = c_l(a_l, s) = \tau(x, s)$$
Contrasting *debt contracts and FSF contracts*

- **Calibration: functions and parameters:**
  \[
  \log(c) + \frac{\gamma (1 - n)^{1-\sigma}}{1 - \sigma},
  \]
  with \(\sigma = 2\), \(\gamma = 1\)
  \[f(n) = n^\alpha, \text{ with } \alpha = 0.58.\]

- **Borrower’s discount factor** \(\beta = 0.96\), while \(r = 0.01\);
  i.e. \(1/(1 + r) = 0.9901\) and \(\eta = 0.9696\)

- **The probability of returning to the market, or fund, after default is** \(\lambda = 0.15\)

- **Tight two-sided limited enforcement contract (2S),** \(Z = -0.1\)
Calibrating for the *PIIGS*

(1980 - 2010, annual)

- $\{\theta_t\}_{t=0}^{\infty}$ as a regimes switching Markov process with three stages, transformed into a nine-state Markov Chain:
  - **Best state:** $\theta_9 \equiv e9$, ..., worst state: $\theta_1 \equiv e1$

- $\{G_t\}_{t=0}^{\infty}$ as a Markov process with three states:
  - **Best state:** $G_3 \equiv g3 = 0$, ..., worst state: $G_1 \equiv g1$

- **Data:** OECD (Debt/GDP), Eurostat (Spreads & Primary surplus), PWT 8.0 (other).
## Contrasting moments

<table>
<thead>
<tr>
<th></th>
<th>Data (1980-2010)</th>
<th>Model (IMD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First moments</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spread</td>
<td>4.21%</td>
<td>3.27%</td>
</tr>
<tr>
<td>G to GDP ratio</td>
<td>16.45%</td>
<td>16.31%</td>
</tr>
<tr>
<td>Primary surplus to GDP</td>
<td>-0.34%</td>
<td>-0.09%</td>
</tr>
<tr>
<td><strong>Relative standard deviations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption / GDP</td>
<td>1.23</td>
<td>1.32</td>
</tr>
<tr>
<td>Labor / GDP</td>
<td>0.63</td>
<td>0.61</td>
</tr>
<tr>
<td>Primary surplus / GDP</td>
<td>0.87</td>
<td>0.20</td>
</tr>
<tr>
<td>G / GDP</td>
<td>0.28</td>
<td>0.98</td>
</tr>
<tr>
<td><strong>Correlations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption &amp; GDP</td>
<td>0.77</td>
<td>0.58</td>
</tr>
<tr>
<td>Labor &amp; GDP</td>
<td>0.53</td>
<td>0.20</td>
</tr>
<tr>
<td>Primary surplus &amp; GDP</td>
<td>0.32</td>
<td>0.23</td>
</tr>
<tr>
<td>G &amp; GDP</td>
<td>0.42</td>
<td>0.31</td>
</tr>
<tr>
<td>G &amp; TFP</td>
<td>-0.019</td>
<td>-0.004</td>
</tr>
</tbody>
</table>
## Contrasting moments (& the Sovereign Debt Puzzle)

<table>
<thead>
<tr>
<th></th>
<th>Data (1980-2010)</th>
<th>Model (IMD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First moments</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debt to GDP ratio</td>
<td>57.32%</td>
<td>4.42%</td>
</tr>
<tr>
<td>Spread</td>
<td>4.21%</td>
<td>3.27%</td>
</tr>
<tr>
<td>G to GDP ratio</td>
<td>16.45%</td>
<td>16.31%</td>
</tr>
<tr>
<td>Primary surplus to GDP ratio</td>
<td>-0.34%</td>
<td>-0.09%</td>
</tr>
<tr>
<td><strong>Relative standard deviations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption / GDP</td>
<td>1.23</td>
<td>1.32</td>
</tr>
<tr>
<td>Labor / GDP</td>
<td>0.63</td>
<td>0.61</td>
</tr>
<tr>
<td>Primary surplus / GDP</td>
<td>0.87</td>
<td>0.20</td>
</tr>
<tr>
<td>G / GDP</td>
<td>0.28</td>
<td>0.98</td>
</tr>
<tr>
<td><strong>Correlations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption &amp; GDP</td>
<td>0.77</td>
<td>0.58</td>
</tr>
<tr>
<td>Labor &amp; GDP</td>
<td>0.53</td>
<td>0.20</td>
</tr>
<tr>
<td>Primary surplus &amp; GDP</td>
<td>0.32</td>
<td>0.23</td>
</tr>
<tr>
<td>G &amp; GDP</td>
<td>0.42</td>
<td>0.31</td>
</tr>
<tr>
<td>G &amp; TFP</td>
<td>-0.019</td>
<td>-0.004</td>
</tr>
</tbody>
</table>
Contrasting debt & FSF contracts
The disruptive effect of default
The low levels of debt and the limited effect of $G$ shocks
The boring beauty of the First Best
The ergodic beauty of the FSF with 2S
Debt & FSF contracts contrasted
Contrasting paths of debt and FSF contracts
Contrasting paths...

- Repeated defaults (to get the spreads rights) in contrast with ‘debt monetisations’ (before the euro) and no sovereign debt defaults, among PIIGS (1980 - 2010).

- Positive spreads ‘anticipating’ defaults when debt is relatively high (even if productivity is also high), with IMD.

- Default episodes mostly driven by productivity shocks: high productivity drops + (relatively) large debt levels, with IMD.

- Larger amount of ‘borrowing’ with FSF.

- Few episodes of ‘negative spreads’, with FSF, when lender’s constraint becomes binding.

- Smoother consumption and, correspondingly, more volatile asset holdings with FSF.
Contrasting persistent shocks in both regimes
Contrasting persistent shocks...

- With an unexpected ‘permanent’ worst \((\theta, G)\) shock, \(FSF\) clearly dominates:
  - With a relatively large asset position (implicit insurance) the country can afford higher consumption with lower labor at the beginning...
  - Even if later the asset position becomes negative (debt) and consumption is marginally lower, than with \(IMD\).
Contrasting impulse response reactions in both regimes
Contrasting impulse responses...

- With an unexpected ‘one-period’ worst \((\theta, G)\) shock, \textit{FSF} clearly dominates:
  - With a relatively large asset position (implicit insurance) the country can afford higher consumption with lower labor at the beginning...
  - Even if later the asset position becomes negative (debt) and consumption is marginally lower, than with \textit{IMD}.

- In contrast, there is a severe crisis with \textit{IMD}!
Contrasting debt contracts and FSF contracts

- Efficiency, (FB), calls for smooth consumption decay (impatience), and labour responding monotonically to productivity.

- FSF (2S) 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.

- FSF contracts are able to exploit better asset trading possibilities (e.g. more borrowing with 2S than with IMD ).
Contrasting debt contracts and FSF contracts

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

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

- With the same underlying shocks, there may be frequent episodes of positive spreads and defaults in IMD, (with re-entry) and harmless negative spreads with 2S.
Contrasting the welfare of both regimes
Debt contracts vs. FSF contracts: WELFARE

A simple measure, $\chi$, of consumption equivalence. FSF with two-sided limited commitment vs. incomplete markets with and without default.

Taking advantage of the decomposition of the welfare functions

$$V^{bj}_c = \log(c_j) + \beta EV^{bj'}_c = E_0 \sum_{t=0}^{\infty} \beta^t \log(c_{j,t})$$

$$V^{bj}_n = \gamma \frac{(1 - n)^{1-\sigma}}{1 - \sigma} + \beta EV^{bj'}_n$$

Total welfare is then equal to

$$V^{bj} = V^{bj}_c + V^{bj}_n,$$

where $j = f, i$; for FSF and incomplete markets, respectively.
Debt contracts vs. FSF contracts: WELFARE

\[ V_c^{bf} = E_0 \sum_{t=0}^{\infty} \beta^t \log((1 + \chi_c)c_i^t) = \]

\[ = \frac{\log(1 + \chi_c)}{1 - \beta} + E_0 \sum_{t=0}^{\infty} \beta^t \log(c_i^t) = \]

\[ = \frac{\log(1 + \chi_c)}{1 - \beta} + V_c^{bi} \]

\[ \rightarrow (1 + \chi_c) = \exp \left( (V_c^{bf} - V_c^{bi}) (1 - \beta) \right) \]
\[ V_{bf}^{n} = E_{0} \sum_{t=0}^{\infty} \beta^{t} \gamma \frac{((1 + \chi_{n})(1 - n_{t}^{i}))^{1-\sigma}}{1 - \sigma} = \]

\[ = (1 + \chi_{n})^{1-\sigma} E_{0} \sum_{t=0}^{\infty} \beta^{t} \gamma \frac{(1 - n_{t}^{i})^{1-\sigma}}{1 - \sigma} = \]

\[ = (1 + \chi_{n})^{1-\sigma} V_{n}^{bi} \]

\[ \rightarrow (1 + \chi_{n}) = \left( V_{n}^{bf} / V_{n}^{bi} \right)^{1/(1-\sigma)} \]

\[ V_{bf}^{n} = E_{0} \sum_{t=0}^{\infty} \beta^{t} \log((1 + \chi)c_{t}^{i}) + V_{n}^{bi} \]
**Significant welfare gains from having a FSF**

*(more significant from bad than from good states)*

<table>
<thead>
<tr>
<th>Conditional: Shocks ($\theta, G'$)</th>
<th>Debt $b$</th>
<th>Welfare Gain $\chi$</th>
<th>$\chi_c$</th>
<th>$\chi_n$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$(\theta_l, G_h) = (0.148, 0.05)$</td>
<td>0</td>
<td><strong>0.062</strong></td>
<td>0.035</td>
<td>0.017</td>
</tr>
<tr>
<td>$(\theta_m, G_h) = (0.186, 0.05)$</td>
<td>0</td>
<td><strong>0.049</strong></td>
<td>0.026</td>
<td>0.014</td>
</tr>
<tr>
<td>$(\theta_h, G_h) = (0.234, 0.05)$</td>
<td>0</td>
<td><strong>0.044</strong></td>
<td>0.025</td>
<td>0.012</td>
</tr>
<tr>
<td>$(\theta_l, G_l) = (0.148, 0)$</td>
<td>0</td>
<td><strong>0.041</strong></td>
<td>0.024</td>
<td>0.011</td>
</tr>
<tr>
<td>$(\theta_m, G_l) = (0.186, 0)$</td>
<td>0</td>
<td><strong>0.035</strong></td>
<td>0.021</td>
<td>0.010</td>
</tr>
<tr>
<td>$(\theta_h, G_l) = (0.234, 0)$</td>
<td>0</td>
<td><strong>0.033</strong></td>
<td>0.020</td>
<td>0.009</td>
</tr>
</tbody>
</table>

**Unconditional: ex-ante**

<table>
<thead>
<tr>
<th></th>
<th>Debt $b$</th>
<th>Welfare Gain $\chi$</th>
<th>$\chi_c$</th>
<th>$\chi_n$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td><strong>0.040</strong></td>
<td>0.023</td>
<td>0.011</td>
</tr>
</tbody>
</table>
Conclusions

- Even accounting for limited redistribution (2S) a FSF can improve efficiency, with respect to debt financing (4% consumption equivalent in our ‘calibration’).

- We do not account for investment disruptions and other socio-political costs.

- The FSF is an inclusive mechanism in a Union.

- Furthermore, costly default events may be prevented or mitigated, even if the economy is subject to the same shocks.

- Similarly, the recession following a negative shock is substantially less severe with a FSF.
Work in progress

• Accounting for moral hazard;
  e.g. changing $G$ for $G(e), G'(e) < 0$, where $e$ is costly, unverifiable, effort.

• Analyzing the capacity of the FSF for absorbing existing debts (we always initialize asset holdings to zero)
  $\implies$ revisiting the Sovereign Debt Puzzle from the FSF perspective.

• Simplifying the conditionality to simplify the FSF implementability.

• Contrasting with the current ESM eligibility & conditionality.
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!
Merci!