Macroeconomic Crises since 1870
by R.J. Barro and J.F. Ursúa

F. Collard

Basic Question

- Basic Question: Provide insight on the ability of rare economic disasters to help explain the equity premium puzzle.

- Intuition: Taking the risk of catastrophic economic downturns explicitly into account should, for a given level of risk aversion, lead the agent to ask for a better return on risky assets.
Basic Question

• Basic Question: Provide insight on the ability of rare economic disasters to help explain the equity premium puzzle

• Intuition: Taking the risk of catastrophic economic downturns explicitly into account should, for a given level of risk aversion, lead the agent to ask for a better return on risky assets.
This paper

- Extend an earlier study by Barro to a longer time span
- Extend Maddison’s data to consumption \(\Rightarrow 24\) countries from 1870 up to 2006 (36 for GDP)
- Apply peak to trough analysis to identify disasters (both in C and GDP).
- Build on these figures to estimate the size and the probability of occurrence of a disaster.
- Use these estimates in a Lucas tree model with Epstein and Zin preferences to explain the equity premium.
This paper

- Extend an earlier study by Barro to a longer time span
- Extend Maddison’s data to consumption $\rightarrow$ 24 countries from 1870 up to 2006 (36 for GDP)
- Apply peak to trough analysis to identify disasters (both in C and GDP).
- Build on these figures to estimate the size and the probability of occurrence of a disaster.
- Use these estimates in a Lucas tree model with Epstein and Zin preferences to explain the equity premium.
This paper

- Extend an earlier study by Barro to a longer time span
- Extend Maddison’s data to consumption \(\Rightarrow\) 24 countries from 1870 up to 2006 (36 for GDP)
- Apply peak to trough analysis to identify disasters (both in C and GDP).
- Build on these figures to estimate the size and the probability of occurrence of a disaster.
- Use these estimates in a Lucas tree model with Epstein and Zin preferences to explain the equity premium.
This paper

- Extend an earlier study by Barro to a longer time span
- Extend Maddison’s data to consumption ⇒ 24 countries from 1870 up to 2006 (36 for GDP)
- Apply peak to trough analysis to identify disasters (both in C and GDP).
- Build on these figures to estimate the size and the probability of occurrence of a disaster.
- Use these estimates in a Lucas tree model with Epstein and Zin preferences to explain the equity premium.
This paper

- Extend an earlier study by Barro to a longer time span
- Extend Maddison’s data to consumption $\Rightarrow$ 24 countries from 1870 up to 2006 (36 for GDP)
- Apply peak to trough analysis to identify disasters (both in C and GDP).
- Build on these figures to estimate the size and the probability of occurrence of a disaster.
- Use these estimates in a Lucas tree model with Epstein and Zin preferences to explain the equity premium.
Main results

- 95 crises for C, 152 for GDP in the World
- Main World crises: WWII, WWI, Great depression, influenza epidemic of the 1920’s, Latin American and Asian financial crises.
- Proba of a disaster: around 3.5%, average size: 21–22%, Average duration: 3.5 years.
- When introduced in a Lucas tree model, these disasters help to account for the equity premium.
- Robust to most perturbations
Main results

- 95 crises for C, 152 for GDP in the World
- Main World crises: WWII, WWI, Great depression, influenza epidemic of the 1920’s, Latin American and Asian financial crises.
- Proba of a disaster: around 3.5%, average size: 21–22%, Average duration: 3.5 years.
- When introduced in a Lucas tree model, these disasters help to account for the equity premium.
- Robust to most perturbations
Main results

- 95 crises for C, 152 for GDP in the World
- Main World crises: WWII, WWI, Great depression, influenza epidemic of the 1920’s, Latin American and Asian financial crises.
- Proba of a disaster: around 3.5%, average size: 21–22%, Average duration: 3.5 years.
- When introduced in a Lucas tree model, these disasters help to account for the equity premium.
- Robust to most perturbations
Main results

- 95 crises for C, 152 for GDP in the World
- Main World crises: WWII, WWI, Great depression, influenza epidemic of the 1920’s, Latin American and Asian financial crises.
- Proba of a disaster: around 3.5%, average size: 21–22%, Average duration: 3.5 years.
- When introduced in a Lucas tree model, these disasters help to account for the equity premium.
- Robust to most perturbations
Main results

- 95 crises for C, 152 for GDP in the World
- Main World crises: WWII, WWI, Great depression, influenza epidemic of the 1920’s, Latin American and Asian financial crises.
- Proba of a disaster: around 3.5%, average size: 21–22%, Average duration: 3.5 years.
- When introduced in a Lucas tree model, these disasters help to account for the equity premium.
- Robust to most perturbations
The role of Disasters

- Benchmark experiment: Epstein and Zin preferences (Just for $r^f$), IES=0.5, RA=3.5

\[ r^e - r^f = 0.05 \]

- Disasters are needed for the result
The role of Disasters

- Benchmark experiment: Epstein and Zin preferences (Just for $r^f$), IES=0.5, RA=3.5

$$r^e - r^f = 0.05$$

- Disasters are needed for the result
The role of Disasters

- Benchmark experiment: Epstein and Zin preferences (Just for $r^f$), IES=0.5, RA=3.5

$$r^e - r^f = 0.05$$

- Disasters are needed for the result

Standard Model

$g_t = \bar{g} + u_t$ and

$$r^e - r^r = \gamma \sigma^2.$$ for $\sigma = 0.02 \implies \gamma = 125$
The role of Disasters

- Benchmark experiment: Epstein and Zin preferences (Just for \( r^f \)), IES=0.5, RA=3.5

\[ r^e - r^f = 0.05 \]

- Disasters are needed for the result

Current Model:

\[ g_t = \bar{g} + u_t + \nu_t \quad \text{where} \quad \nu_t = \begin{cases} 0 & \text{with proba } 1 - p \\ \log(1 - b) & \text{with proba } p \end{cases} \]

\[ r^e - r^r = \gamma \sigma^2 + p E(b((1 - b)^{-\gamma} - 1)) \]

Standard Term \quad \text{Disaster Effect}
The role of Disasters
A Small Phenomenon?

Discussion on Macro Crises since 1870
Role of Disasters
The role of Disasters

Risk Aversion

\[ r^e - r^r = \gamma \sigma^2 + p \, E(b((1 - b)^{-\gamma} - 1)) \]
The role of Disasters

Volatility

\[ r^e - r^r = \gamma \sigma^2 + p E(b((1 - b)^{-\gamma} - 1)) \]
The role of Disasters

Disaster probability

\[ r^e - r^r = \gamma \sigma^2 + p E(b((1 - b)^{-\gamma} - 1)) \]
What is a Disaster?

- In this paper a disaster is a contraction of either GDP or C larger than 10%
- Rather “ad hoc”? Why 10%?
- Assume homogeneity of crises across countries.
- Is a 10% contraction the same “shock” for all countries? For instance, the US and Iceland would probably not suffer from a 10% crisis the same way!
What is a Disaster?

- In this paper a disaster is a contraction of either GDP or C larger than 10%
- Rather “ad hoc”? Why 10%?
  - Assume homogeneity of crises across countries.
  - Is a 10% contraction the same “shock” for all countries? For instance, the US and Iceland would probably not suffer from a 10% crisis the same way!
What is a Disaster?

- In this paper a disaster is a contraction of either GDP or C larger than 10%.
- Rather “ad hoc”? Why 10%?
- Assume homogeneity of crises across countries.
- Is a 10% contraction the same “shock” for all countries? For instance, the US and Iceland would probably not suffer from a 10% crisis the same way!
What is a Disaster?

- In this paper a disaster is a contraction of either GDP or C larger than 10%.
- Rather “ad hoc”? Why 10%?
- Assume homogeneity of crises across countries.
- Is a 10% contraction the same “shock” for all countries? For instance, the US and Iceland would probably not suffer from a 10% crisis the same way!
What is a Disaster?

What is a crisis?
- A big negative event?
- or a shock I’m not used to deal with and which therefore leaves me disarmed? In that case, I may be hurt very much by a small shock!
- Should we consider GDP or C crises? Endowment vs production economies.
What is a Disaster?

- What is a crisis?
- A big negative event?
  - or a shock I’m not used to deal with and which therefore leaves me disarmed? In that case, I may be hurt very much by a small shock!
  - Should we consider GDP or C crises? Endowment vs production economies.
What is a Disaster?

What is a crisis?

A big negative event?

or a shock I’m not used to deal with and which therefore leaves me disarmed? In that case, I may be hurt very much by a small shock!

Should we consider GDP or C crises? Endowment vs production economies.
What is a Disaster?

- What is a crisis?
- A big negative event?
- or a shock I’m not used to deal with and which therefore leaves me disarmed? In that case, I may be hurt very much by a small shock!
- Should we consider GDP or C crises? Endowment vs production economies.
Role of Persistence

- An Issue raised in the paper

• Investigate this issue
Role of Persistence

- An Issue raised in the paper

- Investigate this issue
Role of Persistence

- A possibility:  \( g_t = (1 - \rho_g)g + \rho_g g_{t-1} + u_t + v_t \) where
  \[
  v_t = \begin{cases} 
  0 & \text{with proba } 1 - p \\
  \log(1 - b) & \text{with proba } p 
  \end{cases}
  \]

- Deal with standard preferences (I will not look at the risk free rate)
  \[
  E_t \left( \left( \frac{C_{t+1}}{C_t} \right)^{-\gamma} (R_{t+1} - R_{t+1}^f) \right) = 0
  \]

- Solve it with minimum weighted residual method
- Simulate the model
Role of Persistence

- A possibility: \( g_t = (1 - \rho_g)\bar{g} + \rho_g g_{t-1} + u_t + v_t \) where

\[
v_t = \begin{cases} 
0 & \text{with proba } 1 - p \\
\log(1 - b) & \text{with proba } p 
\end{cases}
\]

- Deal with standard preferences (I will not look at the risk free rate)

\[
E_t \left( \left( \frac{C_{t+1}}{C_t} \right)^{-\gamma} (R_{t+1} - R_{t+1}^f) \right) = 0
\]

- Solve it with minimum weighted residual method
- Simulate the model
Role of Persistence

- A possibility: $g_t = (1 - \rho_g)g + \rho_g g_{t-1} + u_t + v_t$ where

$$v_t = \begin{cases} 
0 & \text{with proba } 1 - p \\
\log(1 - b) & \text{with proba } p
\end{cases}$$

- Deal with standard preferences (I will not look at the risk free rate)

$$E_t \left( \frac{C_{t+1}}{C_t} \right)^{-\gamma} (R_{t+1} - R_{t+1}^f) = 0$$

- Solve it with minimum weighted residual method

- Simulate the model
Role of Persistence

- A possibility: $g_t = (1 - \rho_g)\bar{g} + \rho_g g_{t-1} + u_t + v_t$ where
  
  $$v_t = \begin{cases} 
  0 & \text{with proba } 1 - p \\
  \log(1 - b) & \text{with proba } p 
  \end{cases}$$

- Deal with standard preferences (I will not look at the risk free rate)

  $$E_t \left( \left( \frac{C_{t+1}}{C_t} \right)^{-\gamma} (R_{t+1} - R_{f, t+1}) \right) = 0$$

- Solve it with minimum weighted residual method

- Simulate the model
Role of Persistence

- Benchmark experiment: $\rho_g = 0.2$, $\gamma$ is set such that the EP=0.05 ($\gamma = 2.6$);

<table>
<thead>
<tr>
<th>$p$</th>
<th>EP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0028</td>
</tr>
<tr>
<td>0.0150</td>
<td>0.0232</td>
</tr>
<tr>
<td><strong>0.0363</strong></td>
<td><strong>0.0504</strong></td>
</tr>
<tr>
<td>0.1000</td>
<td>0.1215</td>
</tr>
</tbody>
</table>
Role of Persistence

- Change persistence (preserving volatility)

<table>
<thead>
<tr>
<th>$\rho_g$</th>
<th>EP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.075</td>
<td>0.0513</td>
</tr>
<tr>
<td>0.100</td>
<td>0.0507</td>
</tr>
<tr>
<td>0.150</td>
<td>0.0505</td>
</tr>
<tr>
<td>0.200</td>
<td>0.0504</td>
</tr>
<tr>
<td>0.300</td>
<td>0.0502</td>
</tr>
</tbody>
</table>

- Basically no action!
Role of Persistence

- Change persistence (preserving volatility)

<table>
<thead>
<tr>
<th>$\rho_g$</th>
<th>EP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.075</td>
<td>0.0513</td>
</tr>
<tr>
<td>0.100</td>
<td>0.0507</td>
</tr>
<tr>
<td>0.150</td>
<td>0.0505</td>
</tr>
<tr>
<td>0.200</td>
<td>0.0504</td>
</tr>
<tr>
<td>0.300</td>
<td>0.0502</td>
</tr>
</tbody>
</table>

- Basically no action!
Role of Persistence

- Only a numerical exercise
- May get analytical solution for the equity premium (Same as in CRRA):
Role of Persistence

- Only a numerical exercise
- May get analytical solution for the equity premium (Same as in CRRA):
End of this **Disastrous** Discussion!